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THE ACORN-STORING HABIT OF THE CALIFORNIA WOODPECKER.

BY ROBERT E. C. STEARNS.

THE acorn-storing habit of the Californian woodpecker (*Melanerpes formicivorus*), has long been known to the "country folk" and others who frequent the country and take notes by the way. Before the American occupation, the Spanish Californians had observed this curious habit, and gave the bird the appropriate and musical name "*el carpintero*." No doubt, still further back the aborigines had their name for the *carpintero*, and regarded the bird as invested with superior power, or possessed by some unseen or hidden influence, which placed it above its feathered congeners and proved it to be in some mysterious way a little closer to the heart of nature.

It is highly probable that if we knew the traditions of the former red men of California, we should find some quaint story or curious legend connected with this ingenious and interesting bird. I find no mention of this woodpecker in either Bancroft's[1] or Powers'[2] ethnological volumes, relating to the California tribes.

During a recent visit to Napa county, I noticed near the house where I stayed, on Howell mountain, a fallen pine of the species known to botanists as *Pinus ponderosa*, the yellow pine of the woodsmen, the bark of which was full of acorn holes.

The tree was a noble specimen, and its prostrate position gave me a chance to learn not only its dimensions, but also to ascertain very nearly the number of holes which the woodpeckers had made in its bark.

In falling, the tip of the tree had broken off, and was so hidden in the general débris of fragments of branches, cones and under-

[1] Native Races of the Pacific States.

[2] Contributions to Ethnology, U. S. Geog. and Geol. Survey, Powell, Vol. III, 4to.

brush, as to escape detection. The length was not less than 175 feet, the diameter of the butt just above the ground, five feet ten inches. At ninety feet the diameter was three feet eight inches. Above the ninety foot line the holes continued, but were so scattering that they are not included in the reckoning. Neither are those in the first ten feet of the trunk, as between the ten foot line and the ground they were comparatively few.

Between the ten foot line and the ninety foot line the number of holes to the square foot, with a fair allowance for verification, was from *sixty* to *twelve*. A piece of the bark, sawed from the tree by my own hands, which measures exactly twelve inches by twelve inches, contains sixty holes; this is a much smaller number than could be counted in the same sized piece in a great part of the section of eighty feet, while twelve is a very low minimum.

The two diameters as above given, when added make eight feet and eighteen inches, the average diameter being one-half of this, or about four feet nine inches; this multiplied by three, to get the circumference, gives fourteen feet and three inches; and this again multiplied by the length of the section, eighty feet, produces 1140 square feet.

Now if we add the maximum and minimum of acorn holes to the square foot (sixty and twelve), we have seventy-two, which divided by two, gives an average of thirty-six to the square foot, and thirty-six times 1140 gives a product of forty-one thousand and forty (41,040) acorn holes.

The holes are of different sizes, varying with the size of the acorn, which each hole is made to receive, for these birds are good workmen, and each acorn is nicely fitted into its special cavity. Making a fair selection of acorns as to size, I find that it takes on an average seven to make an ounce (that is, picked when green); and taking that number for a divisor, it shows the total weight of acorns required to fill the holes in the tree, is three hundred and sixty-six pounds seven ounces, avoirdupois. Whether any particular species of acorn is preferred, I am unable to say. The acorns in the tree above described, so far as it was possible to determine them without the cups, which the woodpeckers reject, appeared to belong to the nearest adjacent oaks, *Quercus chrysolepis*. This oak is very abundant all around the mountain and is itself peculiar in having two forms of leaf on the same twig.

At the upper end of Pope valley, not far beyond Ætna springs, I noticed a standing pine of the same species as that described and of about the same dimensions as the foregoing, which was full of holes. In Knight's valley, in August, 1879, I observed woodpecker holes closely set in the bark of a large Douglass spruce *(Tsuga douglassii);* and I have been informed by various parties that these woodpeckers also bore and deposit acorns in the bark of various species of oaks.

Sometimes the acorn holes are made in the *wood*, as I have been informed by a friend, Mr. C. H. Dwinelle, of the University of California, who has seen such holes in a species of white oak in Alexander valley. He also related an instance of the "carpintero" sticking acorns in a crack between the boards in the porch of a house in Redwood city, San Mateo county.

Mr. J. W. Bice, of the University, has also observed acorns stored in the white oaks near Healdsburg, in Sonoma county, as well as in the cracks between the boards in and around the projecting eaves of barns and houses. Where the projecting rafters are boxed in, sometimes they will find a hole, and at other times make one, and store acorns in large quantities in such places.

In clearing land the trees are girdled, and in about two years the bark drops off, leaving the exposed wood of the trunk in a sappy state, particularly on the side which is usually in the shade, and this side is especially selected by the woodpeckers for their purposes. They not infrequently drop acorns down chimneys, where of course the result of their labor is without any advantage.

Upon turning to the volume on Ornithology in the Geological Survey (of California) publications, in reference to this species of woodpecker, it says: "They are fond of playing together around the branches, uttering their rattling calls, and often darting off to take a short sail in the air, returning to the same spot. They have a habit, peculiar to them, of drilling small holes in the bark of trees, and fitting acorns tightly into them, each one being carefully adapted and driven tight. The bark is often so full of these as to scarcely leave room to crowd in another without destroying the bark entirely. These are generally considered as laid up for a winter supply of food; but while in this climate no such provision is necessary, it is also very improbable that birds of this family would feed on hard nuts or seeds of any kind. The more prob-

able explanation is, that they are preserved for the sake of the grubs they contain so frequently, which, being very small when the acorn falls, grow until they eat the whole interior, when they are a welcome delicacy for the bird. Whether they select only those containing grubs, or put away all they meet with, is uncertain; but as they leave great numbers in the tree untouched, it is probable that these are sound acorns, and often become a supply to the squirrels and the jays."

Without questioning the foregoing as to the preference of the woodpecker for animal food, and especially for the larvæ often contained in the acorns, it is undeniable that, in common with the jays, they are exceedingly fond of fruit, as many an orchardist can testify; and their predilection for almonds *before these nuts are quite ripe*, is well known to the cost of many almond growers; that they eat other nuts and also acorns to some extent, I have no doubt. The jays and squirrels are quite likely benefited by the acorn-storing habit of this species of woodpecker; and I have been told that the jay sometimes assists the woodpecker by bringing acorns for the carpintero to deposit in the bark; and further that sometimes the jays put pebbles in the acorn holes "to fool the woodpeckers;" but these latter statements, though perhaps true, need confirmation.

As several woodpeckers are engaged in the work at the same time on the same tree, their operations, as may be imagined, are carried on with a good deal of vivacity and noise, in which the jays become interested, and dart about, adding to the tumult in their own peculiar chattering way.

The latter have related singularities in the matter of food-storing, as will be seen below. The friend, Mr. Dwinelle, whom I have already quoted, states that the large thistle, which is abundant in certain places in Alameda county, owes its distribution in part to the jays who take the seeds, which are of good size, and plant them in the ground. He further states that a friend of his, who fed Indian corn to his chickens, had observed the jays fly down and pick up a kernel and then go off a short distance and plant it; in this way he discovered how it was that stalks of maize came up and were growing where he had never planted.

Mr. Dwinelle has himself seen a jay plant an acorn in the ground of his (Mr. D.'s) house-yard or garden in Oakland. The bird deliberately made a hole, thrust in the acorn, covered it and

then put a chip on the spot, perhaps the latter as a mulch; then flew away, found another acorn, which it accidentally dropped in a growth of periwinkle (myrtle), and after searching for it without finding it, gave up and flew away.

As it is hardly presumable that the jays plant either the corn or the thistle for the purpose of perpetuating those species of plants with the object of obtaining food from future crops, it is likely that being full fed at the time, with appetites satisfied, they simply buried the seed for future need, as a dog buries a bone, and forgot all about it, or not needing the same, the seeds remained where the birds planted them, until they germinated and grew into plants.

The holes made by the woodpeckers in the bark of trees also serve as a lurking place for beetles, ants and other insects, so that both vegetable and animal food are brought together side by side to furnish a meal in time of need, in which perhaps the jays sometimes participate. Judging by the tree herein described, it would seem as if there were enough for all.

Mr. Bice is of the opinion that the acorns are stored simply for the larvæ, which the *carpintero* eats after the maggot has attained a good size. He also relates the following, which is worthy of note: "On cutting down a hollow oak on his father's place, a woodpecker's nest was discovered after the tree had fallen, and a young bird of the *carpintero* species was found and caught, being unable to fly. It was carefully reared, and became a great pet with the family. After it had reached maturity and was perfectly able to fly, though no restraint was placed upon it, it would come at once in answer to call, leaving its fellows in the trees. Upon one occasion, when the family went several miles from home to visit a friend, the bird followed them, though at the time they were not aware of it, and only learned the fact from the friend whom they had visited, and who caught and kept the bird until an opportunity offered for returning it. Probably if it had not been caught it would have followed the family back."

There is a larger species of woodpecker, with plumage much resembling that of *M. formicivorus*, which sometimes appears in flocks and helps itself, or tries to do so, to the stores laid up by *el carpintero*, who bravely fights the maurauder. I have been unable to learn to what species these depredators belong.

OBSERVATIONS ON SOME AMERICAN FORMS OF CHARA CORONATA.

BY T. F. ALLEN, M.D.

Chara coronata Ziz. (in ed. 1814), revised by A. Braun to include all known varieties, belongs to the second division of the genus Chara, namely *Haplostephanæ* (stipules composed of a simple series of cells); it has but one stipular cell at the base of each leaf, is not corticated, is monœcious and is described as follows in Braun's Characeæ Africanæ: "Plant annual, smooth and flexible. *Leaves* verticillate nine to eleven, with 4–6 articulations, 3–5 elongated segments and a short mucroniform ultimate segment. *Bracts* developed at every node; at the terminal node forming with the terminal segment a 3–5 divided crownlet (coronula); the posterior bracts shorter, depauperate or wholly wanting; the anterior about equaling the sporangium, rarely longer, often shorter. *Stipules* about the size of the leaves. *Antheridia* and *Sporangia* produced on the same node, rarely double or triple. *Nucleus* of the sporangium black, with a calcareous shell and with 7–12 conspicuous striæ on a side."

The European form of this species, known as var. *Braunii*, has been considered the normal form, occupying as it does an intermediate position in respect to size, development of bracts, size of nucleus and form of the coronula. The nucleus varies from 420 to 550 μ. (micro-millemeters, mille-millemeters) in length, is 9-striate; coronula of the sporangium is short and obtuse; the bracts anteriorly are equal to or shorter than the sporangium, posteriorly they are undeveloped. This form is found also in America, but the more distinctively American form has been known as var. *Schweinitzii* A. Br. This is usually characterized by a larger nucleus, 550 to 650 μ., and by the great development of the bracts, which are often several times longer than the sporangium and are completely developed around the leaf, verticillate, though the posterior are much shorter than the anterior. An African form, var. *Perrottetii* A. Br., has a large nucleus, 600–650 μ., with unilateral bracts equaling in length the sporangium; this form we find in America also. From India, var. *Coromandelina* A. Br., has been designated by a very large nucleus 600–750 μ., with verticillate bracts, nucleus with seven strong angles; some of our forms approach very closely to this,

having verticillate bracts and an equally large nucleus. In the Sandwich islands is found a delicate form in which the cells of the coronula are much elongated, and approaching this form is one collected in New Mexico by Wright. Besides the more distinct forms are many intermediate forms, difficult to place, possessing characters belonging to two or more varieties; indeed the forms of this species from different places are quite numerous. We find the plant everywhere from Canada to Mexico and from Massachusetts to California.

One interesting fact is, that the plant in any given locality is constant in its peculiarities, and though thousands of plants be examined they will all be found to exhibit precisely the same character. This is true not only of this species but of most other species of Characeæ; thus in a pond filled with *Chara fœtida* A. Br., with long bracts and long terminal naked nodes (Macroptila, Macroteles) all the plants will have the same peculiarity and will keep it unchanged year after year, while a neighboring pond perhaps only a few rods distant, may be inhabited by another distinct but persistent form.

A. Braun relates that *Chara gymnopus* var. *Humboldtii* A. Br., collected by Gollmer in the same lake in which fifty-five years before Humboldt had gathered it, presented precisely the same characters. We have, however, noticed in one instance an apparent difference in a form of *C. coronata* collected in precisely the same locality in which it had been found twenty years before, but there might have been a difference in the maturity of the plants. This permanence of slight peculiarities may be owing to the disagreeable odor and taste of the plant, which has often a strong smell of sulphuretted hydrogen, rendering it offensive to animals who might otherwise feed upon it and carry the seeds to other localities; and as the plants grow wholly under water, the seeds are not liable to be carried by the wind. Hybridization seems, therefore, to be infrequent and exceptional. These very qualities, which serve to limit the spread of the Characeæ, may also have determined the persistence of very ancient forms and limited their multiplication.

The characters relied upon for distinctions betweeen varieties, have been the development of the bracts, the size and striation of the nucleus, and the character of the coronula of the sporangium. The general aspect of the plant, size and length of stem, density

or laxity of growth, seems to vary greatly from differences in the character of the water, exposure, et cetera. The plant has been thought to be free from incrustation, but one form from Canada (Pacific Railway survey) is so completely incrusted that it is extremely brittle, and when dry has a gray color; while another form has a most peculiar zonular incrustation, giving the plant a variegated appearance.

The development of bracts seems to be most capricious; though the comparative length of bracts and sporangia seems to be pretty constant in any one locality, the *posterior* development varies in a single plant, and at times on a single leaf, one node exhibiting verticillate bracts while the next node has absolutely no bracts on its dorsal aspect: this we often find to be the case in the longest bracted forms (var. *Schweinitzii).*

In America we have every length of anterior bracts from two to three times the length of the sporangium, a little longer, of equal length, a little shorter, to very short bracts, one-half or even a third its length. Some of the shortest bracted forms are found with the largest sporangia and with verticillate bracts.

Size of nucleus.—The smallest, mature nucleus we have yet met with occurs in the form collected by Wright in New Mexico, and determined by A. Braun as var. *Braunii* forma *tenera;* it is 420 μ. long and has seven striæ; next in order is the Silver-city form, recently found, 500 μ. with only five striæ; one from California is 500 μ. long with seven striæ; from Saranac lake, Vermont, N. Carolina, etc., are forms 520 to 550 μ. long with longer or shorter bracts; then come the more common long-bracted forms (var. *Schweinitzii)* with nucleus 550 to 650 μ. long with 8 to 9 striæ; then some forms with larger nucleus and very short bracts, Penn. and Kansas, 660 to 780 (!) long with 9 to 10 striæ. Both the smallest and largest nuclei now known to us have been associated with short bracts.

The number of striæ on the nucleus, representing the whorls of enveloping cells, varies considerably; while in a general way they are more numerous on the longest nuclei, yet a smaller nucleus may have more than one somewhat larger; the delicate Saranac form has 9 striæ, while the larger Vermont form has only 7 (the same as the delicate *Braunii-tenera*) though the nucleus is larger. The Silver-city form with a nucleus 500 μ. long has 5 striæ, while *Braunii-tenera* nucleus 420 μ. has 7 striæ.

The cells of the coronula vary greatly from the closely-set short cells of the more common forms to the divergent and elongated cells of *Braunii-tenera*, which exhibits an approach to the Sandwich island form (var. *Oahuensis* A. Br.).

These varying characters with their numerous combinations seem to us to render a division of the species into definite varieties well nigh impossible. As it has now become unadvisable to bestow distinctive names upon the numerous forms of that truly polymorphic species *C. fœtida* A. Br., so in view of the now numerous and rapidly multiplying forms of *C. coronata*, it seems to us proper to describe them as *forms* peculiar in many cases to certain localities.

The variations of this plant may be tabulated as follows, giving prominence to the size of the nucleus and length of the bracts, allowing also for variations in the habit of growth, et cetera:

I. *Microcarpa*, nucleus less than 500 μ. in length.

1. *Macroptila*, bracts longer than the sporangia, verticillate or unilateral.
   a. Condensata, verticils approximate, the leaves longer than the internodes.
   b. Laxior, leaves loose, spreading.
   c. Clausa, leaves compact, incurved.
   A. Pachygyra, nucleus with thick prominent angles.
   B. Leiopyrena, nucleus smooth, or with but slightly prominent angles.

2. *Microptila*, bracts shorter than the sporangium, verticillate or unilateral.
   a. Condensata.
   b. Laxior.
   c. Clausa.
   A. Pachygyra.
   B. Leiopyrena.

3. *Meioptila*, bracts equaling the sporangium in length.

II. *Macrocarpa*, nucleus more than 600 μ. in length.

1. Macroptila, microptila or meioptila.
   A. Pachygyra or Leiopyrena.
   a. Condensata, laxior or clausa.

III. *Meiocarpa*, nucleus of medium size, between 500 and 600 μ. long. Variations as above.

The American forms may be arranged and designated as follows, beginning with those having the smallest nucleus:

1. Forma tenuior, microcarpa, microptila, unilateralia, laxior, oxygyra (var. *Braunii tenera* A. Br.). This form was collected

by Wright in New Mexico (No. 908). It is a slender diffuse plant, with rather long leaves of 5–6 articulations, including the terminal one. The stipules and bracts are very slender; the bracts are unilateral, shorter than the sporangium, the anterior rather longer than the lateral. The coronula of the sporangium consists of five cells *with elongated diverging tips*, intermediate in aspect between var. *Braunii* and var. *Oahuensis* A. Br. The sporangia and antheridia are usually duplicated on each of the two lower nodes. The terminal segment consists of three slender elongated cells forming a tuft. The nucleus is oval with about seven sharp angles, 420 to 460 μ. long and about 250 μ. broad. In the adjoining cut *1* represents the anterior aspect of a node with two sporangia but with the antheridia removed, as at 3. 2 is a terminal node—all magnified forty diameters.

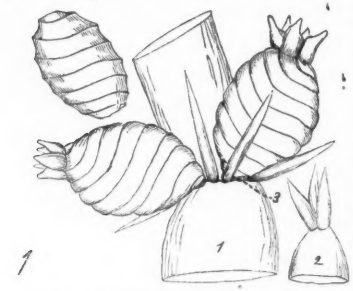
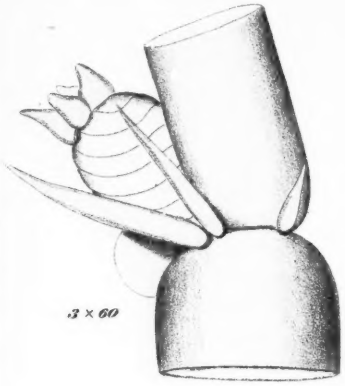


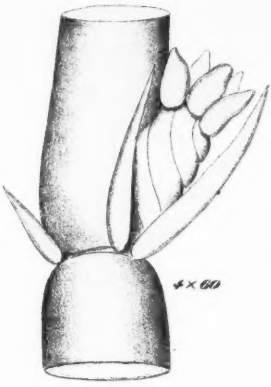
FIG. 1.—Variety *Braunii tenera.*

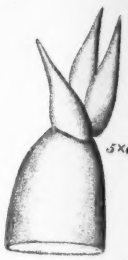
II. Forma microcarpa, microptila, unilateralia, laxior (var. *Braunii genuina*). This form has been collected near St. Louis by Dr. Engelmann (to whose kindness I am indebted for specimens). Plants diffuse, leaves longer than the internodes, 4–5 articulations, of which the lowest or the two lowest are fertile; stipules rather stout but short; bracts stout, unilateral, much shorter than the sporangium. Coronula of five connivent, blunt cells. Nucleus broadly oval, 475 to 500 μ. long, with about six ribs, which are blunt and not prominent. The accompanying figure, magnified forty times, represents the anterior aspect of a node of a leaf, with two sporangia, one antheridium, in situ (outlined) and one removed; only the anterior bracts are shown, the lateral are about the same length.

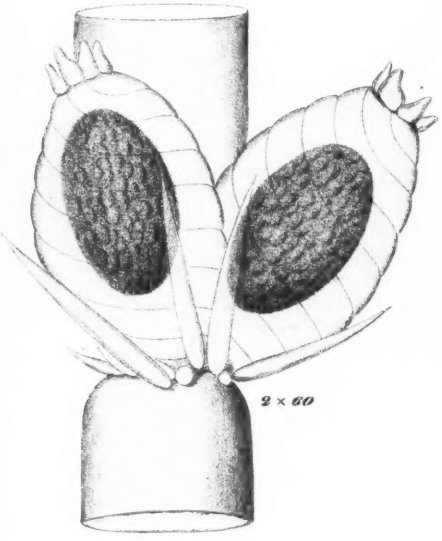
FIG. 2.—Variety *Braunii genuina.*

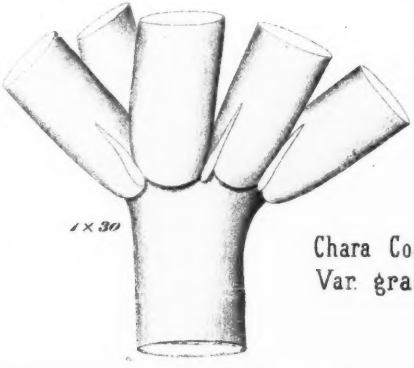
III. Forma meiocarpa, microptila, verticillata, elongata, clausa,











Chara Coronata, Ziz.
Var. gracilis, Allen.

pachygyra (var. *gracilis* Allen ined.). Plant slender, elongated, 15 to 20^{cm} in height. Verticils consisting of 9–10 leaves, distant. Leaves much shorter than the internodes, the lower spreading; the upper fruiting ones connivent; articulations few, usually three, the two lower nodes bearing fruit, the upper sterile, the fertile nodes usually connivent while the subterminal internode is elongated and divergent. Stipules very slender and rather short; bracts slender, usually verticillate, much shorter than the sporangium, the anterior longer than the lateral, the posterior very small, sometimes wanting, the terminal bracts form, with the short terminal segment of the leaf, a triple tuft. Sporangia and antheridia usually duplicated on the two lowest nodes of the leaf. Sporangia large in comparison with the size of the plant, with about eight whorls on one side; coronula of short pointed somewhat divergent cells; altitude of cells of coronula in mature sporangia about 100 μ. Nucleus broadly oval, 480 to 520 μ. long, with five or six thick ribs.

This form differs in habit of growth from all other known varieties. It was gathered near Silver City, New Mexico, by Mr. Rushy in 1880, being found in only one pool. It occupies an intermediate position between var. *Braunii tenera* (Forma 1) and the large fruited forms from Pennsylvania and Kansas, which seem almost identical with the East Indian var. *Coromandelina* A. Br. Explanation of the plate; 1, a partial view of a verticil, showing the relative size and position of the stipules; 2, a front view of the first node of a leaf, showing at *a* the points of attachment of the antheridia which have been removed; 3, a lateral view of a second node, with a younger sporangium, showing the verticillate bracts; 4, another second node, with a very young sporangium; 5, the terminal segment of a leaf; 6, a ripe nucleus.

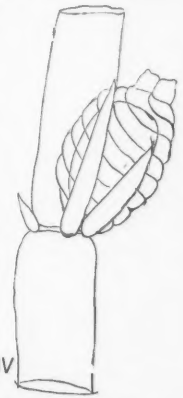


FIG. 4.—*Chara coronata*, var. 4.

IV. Forma microcarpa, meioptila, verticillata, tenuior. This form was collected in California, at "King's river," by Berggren in 1875, and sent me by Professor Nordstedt. The plant is slender and diffuse, and is intermediate between the extreme small-fruited unilateral forms and the medium-fruited verticillate ones. The bracts are verticillate,

the anterior shorter than the lateral, which about equal in length the sporangium; the coronula consists of short thick cells with a minute point, not at all developed as in *Braunii tenera*. Nucleus 425–500 μ. long, with 6–7 angles.

We now come to a group of forms representing in a general way the ordinary var. *Schweinitzii*, though the transition from the short bracted and small fruited forms to the large bracts and large fruit, is gradual. The bracts subtending the sporangium vary in relative length, sometimes the anterior, sometimes the lateral bracts are longer. The form with long lateral bracts has been known as *Chara foliolosa* Schw., the one with shorter bracts but long leaves, as in Form III. as *C. opaca* Schw.

v. Forma macrocarpa, meioptila, verticillata, tenuior, leiopy-

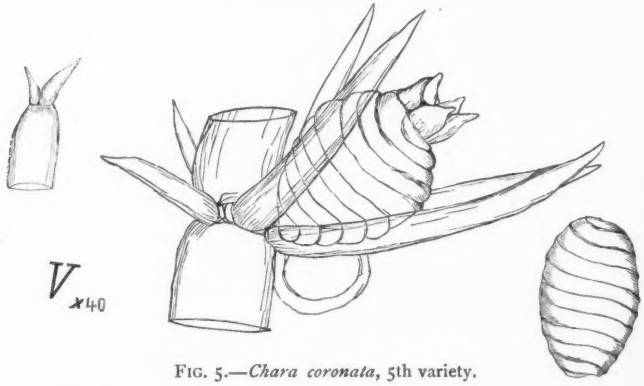


FIG. 5.—*Chara coronata*, 5th variety.

rena. Plant small, diffuse, with elongated leaves of 4–5 articulations; bracts usually verticillate, equal in length to or slightly longer than the sporangium, anterior bracts somewhat longer than the lateral, posterior often nearly as long as the lateral, rarely wanting. Sporangium with 9–11 whorls, coronula of divergent cells with rather long points, similar to *Braunii tenera* of New Mexico (Forma 1). Nucleus 640 μ. long with 9–11 slightly prominent ribs. Saranac lake, N. Y., 1881.

In previous years Professor C. H. Peck, of Albany, collected specimens from precisely the same locality, and in 1860 I sent specimens to Professor A. Braun, who recognized it as a transition form between var. *Braunii* and var. *Schweinitzii*; the ac-

companying drawings are taken from Professor Peck's specimens.

The bracts are shorter and unilateral, the nuclei smaller, 550 μ., but the coronula seems less elongated; whether the plant still continues to vary, remains for farther investigation to establish.

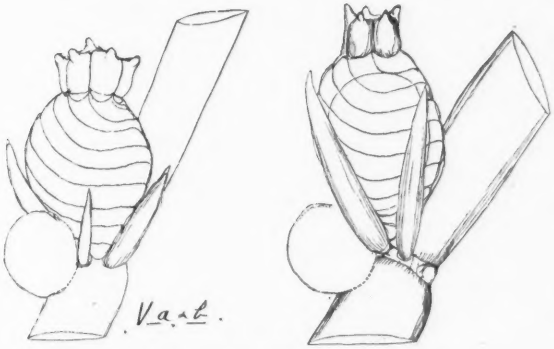


FIG. 6.—*Chara coronata*, 5th variety, *a* & *b*.

VI. Forma macrocarpa, macroptila, verticillata, laxior, leiopyrena. This very common northern form was collected in Canada by Professor Macoun; it is slender, diffuse, with long leaves of 4–5 articulations, verticillate bracts much longer than the sporangium, often two or three times its length, the anterior bracts longer than the lateral, the posterior large but much shorter. Nucleus precisely like the Saranac form (v), and about the same size, 620–650, ribs 9–10, scarcely prominent.

One collection of this form from the far west of Canada is completely incrusted with lime, and when dry is gray and very brittle; another from Eastern Canada has a peculiar zonular incrustation bu. usually the plant is perfectly smooth even in water containing considerable lime. The habit of growth varies exceedingly, some are delicate, diffuse and pellucid, others stout, thick, compact, and in deep water often attain a length of 4 to 5 feet (Litchfield lake, Ct.). This is our most common form, though the cells of the coronula are usually connivent, as in the next form, and the bracts may be unilateral on some nodes of the same plant.

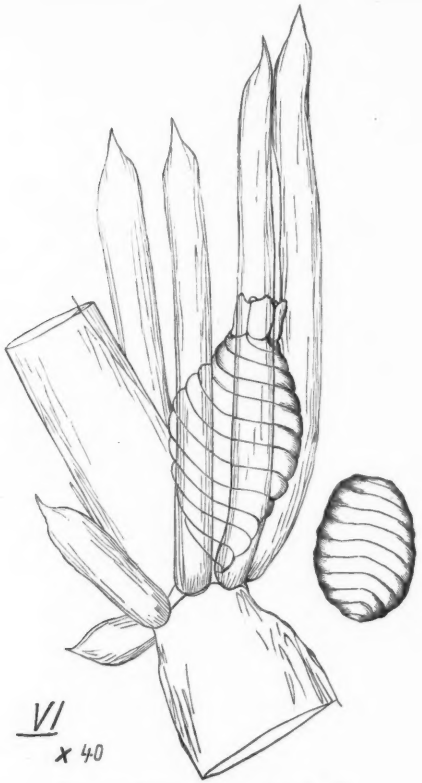


FIG. 7.—*Chara coronata*, 6th variety.

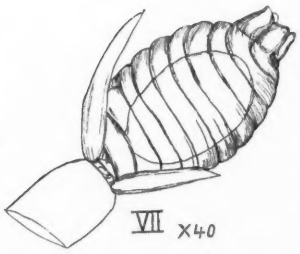


FIG. 8.—*C. coronata*, 7th variety.

VII. Forma meiocarpa, microptila, unilateralia, laxior. This form was collected at Brattleboro, Vt., by the late C. C. Frost, it presents no differences from the last except the short unilateral bracts, smaller nucleus, 550–600, with fewer ribs, 7–8.

VIII. Forma meiocarpa, meioptila, partim unilateralia, cellulis coronulæ sporangii conniventibus, condensata. Plants compact,

rather stout, verticils approximate; stipules large, inflated, equaling the leaves in size. Bracts inflated, about equal in length to the sporangium or somewhat shorter, mostly unilateral, sometimes verticillate; leaves with 5–6 nodes, the three lower usually fertile; sporangium with about nine whorls on one side, *coronula connivent blunt;* nucleus nearly smooth with about seven angles, 550–575 μ. long. Collected in Vermont by Mr. Horsford.

From Hillsborough, N. C., have been collected specimens by Mr. Curtis (communicated by Dr. Engelmann) of

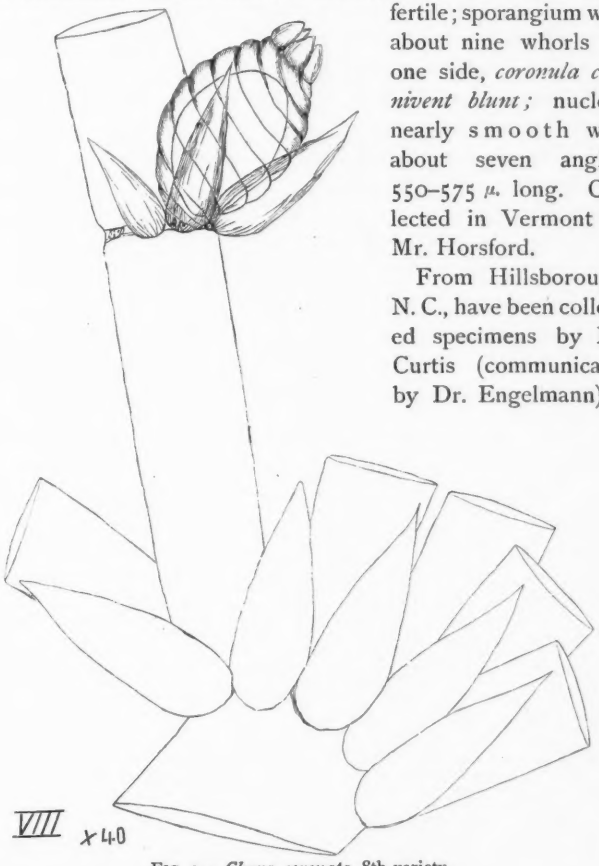


FIG. 9.—*Chara coronata*, 8th variety.

a form almost identical with this one, except that the leaves have only three nodes, the lower of which is fertile, *the upper much elongated*, and the bracts commonly verticillate and somewhat narrower.

IX. Forma macrocarpa, microptila, verticillata. The plants belonging to this form are remarkable for the large size of the fruit

and the small verticillate bracts. The specimens from Pennsylvania were collected "in a flume" by Mr. E. A. Rau. The plants are diffuse, thin and transparent; stems long; verticils approximate at upper part; leaves long, spreading, with two fertile nodes and 2–3 sterile; the upper internodes much elongated. Bracts much shorter than the sporangium, verticillate, the anterior longer than the lateral; coronula of the sporangium consisting of connivent blunt cells; nucleus elliptical, about twice as long as broad, 650 μ. long, with nine faint striæ. Very similar to this, apparently, is a form from Kansas, collected by Fendler and communicated to me by Dr. Engelmann, of St. Louis. The leaves are long, consisting of four nodes, of which the lowest is fertile; the upper considerably elongated. The bracts are less than half the length of the sporangium, verticillate, *the anterior shorter than the lateral;*

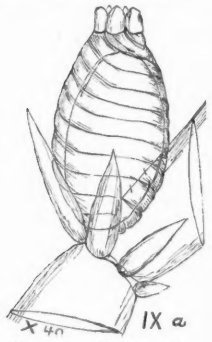


FIG. 10.—*C. coronata*, 9th var.; *a*.

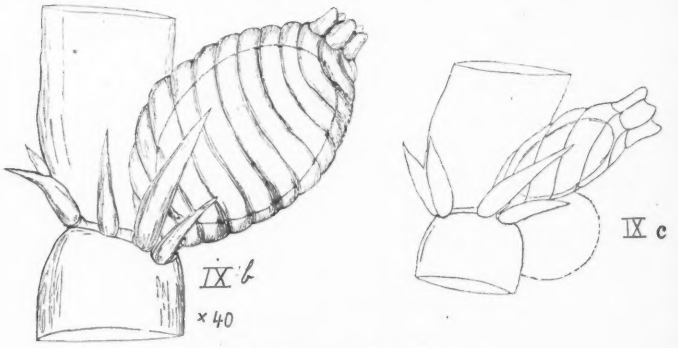


FIG.—*Chara coronata*, 9th variety; *b*, *c*.

coronula with blunt somewhat connivent cells, the sporangium large with about twelve whorls on one side. Nucleus gigantic in size, 760–780 μ. long with 9–10 faint striæ. This form is truly western in the enormous development of nucleus, but in no other respect does it seem to differ from eastern forms. *b*, a mature fruit; *c*, very young, showing a large antheridium. The figures have all been drawn with the camera lucida from actual specimens, and are perfectly true to nature.

To these forms we have been able to refer all the specimens

which have thus far been collected in America; they seem to illustrate the futility of attempting to define satisfactorily varieties, and to warrant their abandonment and the substitution of "*forms*," varying with the locality, as has been suggested by Professor Nordstedt, of Sweden, and is the practice in the case of the polymorphous species, *C. fœtida* A. Br., *C. intermedia* A. Br., and many others.

A few of the more remarkable forms may still retain a specific name, as var. *Oahuensis* A. Br., perhaps var. *gracilis* Allen, and a few others; or it might even be admissible to bestow a specific name on each constant form as a convenient method of designating its peculiarities. For the present, however, while our knowledge of the American forms is yet so incomplete, we prefer to classify them as above.

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THE LOESS OF NORTH AMERICA.

BY R. ELLSWORTH CALL.

THE term loess is a purely provincial one, having been originally applied by the residents of the Rhine valley to a certain comparatively recent formation bordering that stream. It is the anglicized form of the German *lösz*, itself a derivative of the verb *lösen*, to loose or to detach. It was evidently bestowed in allusion to the loose texture of that loam-like soil, and, in its present acceptation, is to be regarded as nearly the equivalent of the English *loam*.

Historical.—The earliest notice of the loess in America appears to have been in connection with various exploring expeditions sent out by the General Government. That of Lewis and Clark, made between the years 1803–1806, to the Rocky mountains, by way of the Missouri river, called attention to the remarkable character, both physical and lithological, of the bluffs along that stream, but for aught the report contains their true geological position and history were not recognized. Later, the celebrated artist, Catlin, in his letters to England from the Northwest,[1] gives a very accurate and graphic account of the Missouri river bluffs, in which he mentions certain of their remarkable physical peculiarities.

The real geological character of this formation in the United

[1] Catlin's N. A. Indians, Vol. I, p. 19, 1876. London, Chatto & Windus.

States seems to have been first surmised by Sir Charles Lyell, whose observations, however, were confined to the lower Mississippi, and notably to this deposit in the State of that name. He had traveled extensively in Europe, and in the progress of his journeyings had taken occasion to study somewhat carefully the Rhenish loess. In the first edition of his "Elements of Geology," published in 1838, he mentions at some length the loess deposits of the Rhine, and states that it is mineralogically and chemically similar to the famous deposits in the delta of the Nile. He also offers a few considerations touching its origin, to which it is not here necessary to make reference. Later, in 1846, while Lyell was in this country, Professor Wailes, of the Mississippi Geological Survey, drew his especial attention to the deposit as laid down in certain ravines in Adams county, in that State. In the subsequently published account of his travels, Mr. Lyell remarks that "the resemblance between this loam and the fluviatile silt of the valley of the Rhine, generally called loess, is most perfect."[1] Following him, most writers on the loess of the Mississippi valley consider it the counterpart of the Rhenish formation. About this period a large portion of the great hydrographic basin of the Mississippi was being for the first time geologically explored under the general and various State governments, so that discoveries of this deposit over large areas appearing *to border upon the principal streams only*, were both numerous and important. In Iowa, the first study of the loess was made by Dr. D. D. Owen, and reported upon to the General Government in his "Geological Survey of Wisconsin, Iowa, and Minnesota," published in 1852. He crossed the state from Des Moines, then a mere military post, to its western limit. Commenting on the rock structure as he advanced, he says:[2] "On approaching the Missouri, the hills bordering the extensive bottoms, known as Council Bluffs, attract particular attention, not only from their contour, but from their geological formation. Where vegetation has been removed from their slopes, they are seen to be composed chiefly of a fine ash-colored, silicious marl, or loam, effervescing with acids. In favorable situations many species of terrestrial and fluviatile shells were discovered, of the same species as are found in similar

[1] Quoted by Wailes in "Report on the Agriculture and Geology of Mississippi," 1854, p. 213.

[2] *Op. cit.*, p. 132.

deposits in the Wabash valley, which are considered contemporaneous with the loess of the Rhine." At about the same time loess was found by Whittlesy[1] on the south shore of Lake Erie, and from the presence of fresh-water shells he likewise inferred that the formation belonged to the age of the Rhenish lacustrine deposits. In writing on the superficial geology of the Lake Superior section, E. Desor concludes that "though the terraces of Mackinac differ widely in composition from the loam, or loess, of Lakes Erie and Huron, yet, the fact that both are posterior to the drift and occur at similar heights on the coast of the same lake, seems to warrant the conclusion that they may have been simultaneous." Whether those deposits are to be considered *true loess*, we are not prepared to state.

The field of discovery and study now again reverted to the south, for, in 1854, was published Wailes' account of this formation as existing in Mississippi. One year later appeared Swallow's "First and Second Reports on the Geology of Missouri," in which is given, for the first time, a full account of the loess, to which Professor Swallow applies the name of "bluff formation." This work was followed in the succeeding year, 1856, by Owen's "Report on the Geology of Kentucky," in which occur numerous references to the loess of that State. In the same year was published Volume III of the Pacific Railroad Reports, in which W. P. Blake, in giving an account of the geology of the thirty-fifth parallel, extends the geographical distribution of the loess to twenty-six miles above Fort Washita on the Red river, and quotes the observations of Shumard, made in the same section during the explorations under charge of Captain Marcy, in 1852.[2] In 1860, E. W. Hilgard, in his "Agriculture and Geology of Mississippi," gave the most complete account of the loess of the south yet published. In Nebraska, during the year 1867, it was studied by Dr. Hayden, and later by Prof. Aughey, who published an account of the surface geology of that State in Hayden's Annual Report for 1874. Meanwhile, Safford in Tennessee had published, in 1869, his account of the geology of that section; and White's "Geology of Iowa," which appeared in 1870,

[1] Report on the Geology of the Lake Superior Land District, 1851, Foster & Whitney. Pt. II, p. 248.

[2] "Exploration of the Red river of Louisiana," pp. 28–29. The common error is here made of referring the fossils found to European species. *Pupa muscorum*, *Succinea elongata*, and *Helix plebium*, are named.

contains the most finished treatment of the Iowa loess, and incidentally that of Missouri and Nebraska, which has come under notice. The last elaborate study, to which it is here necessary to make reference, is contained in the "Sketches of the Geology and Physical Geography of Nebraska," by Professor Samuel Aughey, which is, mainly, so far as the loess is concerned, an extension of his previously published paper in the report of the Hayden survey above mentioned.[1]

From these facts it will have been gathered that the loess is of wide distribution in the great central basin of the United States, to which it seems wholly confined. It is found in the States of Ohio, Indiana, Michigan, Iowa, Kansas, Nebraska, Illinois, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kentucky, and in the Indian Territory; but *in every instance* is apparently confined to the higher lands along the larger streams. Its superficial extent is greatest in Nebraska, where, according to Aughey,[2] its area is three-fourths that of the State, or 56,994 square miles.[3] In Iowa its superficial area is estimated by White[4] at about 5000 square miles, but his calculations included only those sections along the Missouri, inasmuch as he was evidently unacquainted with its existence in Central Iowa, and in the eastern portion of the State. Its area appears to be next greater in Missouri, which is, indeed, but the southern extension of the Iowa and Nebraska deposit. In most of the other States where it occurs its area is comparatively small.

Physical characters.—Observers agree, in the main, with reference to the physical features of this formation. Its material is exceedingly fine, very silicious as proven by numerous analyses, ashy color with slight yellowish tinge—normally; and often highly calcareous. In all these respects it agrees entirely with published descriptions of foreign loess. *In situ* it presents a remarkably homogeneous structure, usually appearing in massive walls without, or with but faint, lamellation, the latter feature be-

[1] It is not possible to note here all the minor papers, however important, that bear upon the different aspects of the loess. The reader is referred to the accompanying bibliography for all other details of publication.

[2] Sketches, &c., p. 265.

[3] "I should judge that the true loess covered about one-fourth to one-fifth of the State, not more. It is largely confined to the borders of streams and the eastern portion." Professor Hayden, *in litt.*

[4] Geology of Iowa, Vol. I, p. 127.

ing purely local. So perfect is the homogeneity that very careful examinations of specimens of soil from the Missouri valley, and the valleys of the Des Moines and Iowa rivers, failed to reveal even slightly marked physical differences. A peculiar feature of the loess—in all parts of the world—is the presence of numerous calcareous concretions—the *löessmännchen* of the Rhenish deposits—which occur in zones, at varying distances throughout the mass. They assume all possible shapes from the spherical (Plate v, Fig. 4) through the spheroidal to the oblong; in all cases they are more or less numerously studded with roughened projections. No one shape seems to obtain more than another, and not unfrequently several are found cemented together, forming an eccentric single mass. They are certainly characteristic of the loess, for that formation nowhere occurs without their presence. They are decidedly hydraulic as would be naturally inferred from their constitution. In no case have I ever observed fossils—either mollusks or vegetable matters—acting as a nucleus. On one occasion, 2803 of these bodies were crushed with that especial point in view. In nearly every instance, 2789, they were found to contain loose fragments broken by some means from their inner walls, but no foreign substance whatever could be detected.[1] In the remaining fourteen specimens, while the concretions were hollow, they yet contained loose particles of no substance whatever. Not a single specimen was solid throughout. That they were originally solid, or of a pasty consistency, is not to be doubted, as a study of the inner surface reveals. They all present a deeply fissured interior (Plate v, Fig. 1),[2] consequent on the evaporation of water and subsequent contraction. In the vast majority of cases the pyramidal masses of the interior showed distinct irregularly concentric lines of growth, or rather of accretion (Plate v, Fig. 2). The presence of these zones and the peculiarly granulated surfaces of the crushed masses, with entire absence of distinct crystallization when viewed under the microscope[3] complicates somewhat the problem of their

[1] On being shaken a rattling sound is produced, owing to these separated fragments violently striking against the inner walls of the concretions. This has earned for them among the boys of this city, the appellation of "rattle-boxes," for which reason they seem to be in great demand.

[2] View of a transverse section of spherical loess concretion, showing interior: *a*, peripheral layer, highly calcareous; *b*, pyramidal appearance of interior caused by the numerous deep fissures *c*; natural size.

[3] Professor A. F. Gray, *in litt.* So also my own examinations.

origin. Professor J. D. Whitney says of them[1] that they "have been formed in the loess by infiltration along the lines of cleavage and resultant chemical action on calcareous matter occurring in large quantity along certain planes."

It should be noted, in framing any theory on these peculiar bodies, that *without exception* the fissures of the interior surface end with the outer calcareous envelope, as shown in Plate v (Fig. 1 and 2, *c* and *a*). So also should be considered the numerous rugosities or protuberances more or less thickly studded over their surfaces (Plate v, Fig. 3).[2] Further, there often occur, in the pyramidal masses of the interior, numerous small black masses, apparently carbonaceous, the true nature of which has not yet been satisfactorily determined. I am, however, disposed to consider these concretions as a result of chemical changes in the composition of the loess itself through the action of carbonic and various of the humus acids. These exert, as is well known, a marked action upon certain mineral substances contained in soils, as notably upon carbonate of lime.[3] Whether there may have been an original foreign nucleus about which accretion began I am unable to say, but the *fact* is, that in none of the above mentioned 2803 specimens could any such nucleus be found.

On one other point the writer's observations lead to negative results. In *every case*, even when from considerable depths, the concretions are of a stony hardness. One observer[4] states that "when first exposed, most of these concretions are soft enough to be rubbed fine between the fingers, but they gradually harden by being exposed to the atmosphere." Furthermore, the portion interior to the outer calcareous envelope is largely, more than one-half, carbonate of lime. A little more than one-third is silica, with a small per centage of alumina. We have here, then, the conditions which produce their hydraulic properties, a fact in itself sufficient, almost, to lead to a belief in their universal hardness.

Another feature of the loess remains to be noticed, which is in some particulars its most remarkable characteristic. Reference is

[1] AMERICAN NATURALIST, Vol XI, p. 709.

[2] This figure represents a form of twin concretion fairly common in the loess deposits of this city, Des Moines, Iowa.

[3] *Vide* Darwin's "Vegetable Mould and Earth Worms," p. 140, *Ibid.* p. 240. In this wonderful volume the reader will find numerous facts bearing on this point.

[4] Aughey, Sketches, &c., p. 266.

here made to the almost or quite vertical planes of cleavage. Wherever streams, both great and small, have eroded channels through the deposit, or when they undermine the resulting cliffs, the masses that become detached break off in planes parallel to the original cleavage planes. This is especially remarkable since the material of the loess is not cohesive, and not at all plastic, unless thoroughly saturated with water. The use to which this feature has been put is well illustrated by the great work of Richthofen on China. In our country it is most common to meet with bluffs that are more or less rounded, a condition due to the action of rains and frosts.

Microscopical and Chemical Features.—The soil of the loess presents an unusually beautiful field when viewed with a good working microscope. A number of such examinations were made (1) of soil as taken *in situ*, in which were presented minute granules of pure silica of an average diameter of $\frac{1}{500}$ to $\frac{1}{1000}$ of an inch; (2) of soil after treatment with strong nitric acid, when the same features were prominent, the silica granules merely appearing somewhat brighter. None of the olive-green crystalline particles, found by Pumpelly in the Chinese loess, were to be found, while in our examinations, as in his, there were no remains of minute organisms, such as diatoms.[1] In most cases the granules were devoid of the sharp angles which recently detached particles of silicious rocks give. This may, in part at least, be due to the action of the acids mentioned above, and in part to attrition against one another. They were all irregularly ovoid and somewhat translucent bodies, but occasionally discolored by some one or another of the iron oxides.

Numerous analyses made by several observers, rate the approximate quantity of silica in the loess soil at from seventy-five to eighty per cent. Blow-pipe analysis, conducted solely with a view to qualitative ends, gave, as constituents of the soil from the Missouri river and Des Moines valley deposits, water, phosphorus (trace), sodium (trace), iron (trace), calcium, magnesium, aluminum and silica. To present more clearly the nature of the soil, its value agriculturally, and as anticipatory of its mode of origin, the following table will be found useful and instructive. I give, also, in juxtaposition, the average of the results of Bischoff's ex-

[1] The examinations were conducted by the writer and Dr. A. G. Field, to whom the instrument used belonged. It was a Zentmayer's Centennial improved stand, with the A eye-piece and 8-10 objective.

amination of the Rhenish loess, to enable ready comparison:

TABLE SHOWING THE CHEMISTRY OF THE LOESS.

Composition of Missouri Loess.	Average of four Analyses by Litton.	Composition of Nebraska Loess.	Average of five Analyses by Aughey.	Composition of Iowa Loess.	Average of two Analyses by Emery.	Composition of Rhine Loess.	Average of five Analyses by Bischoff.
Silica	77.4275	Insoluble (silicious) matter	81.334	Insoluble (silicious) matter	84.85	Silicic acid	72.136
Alumina and peroxide of iron	12.83	Ferric oxide	3.854	Ferric oxide	3.77	Alumina and peroxide of iron.	15.362
Lime	3.2425	Alumina	0.742	Alumina		Lime[1]	0.02
Magnesia	1.4975	Lime carbonate	6.058	Calcium carbonate	8.33	Magnesia	0.298
Carbonic acid and water	2.765	Lime phosphate	3.584	Magnesium carbonate	1.70	Potash and soda	2.094
		Magnesia carbonate	1.294	Moisture	1.10	Carb. lime[2]	15.895
		Potassa	0.316	Organic matter, traces, and loss	1.25	Carb. magnesia.	3.615
		Sodium	0.154			Loss	1.114
		Organic matter	1.06				
		Water	1.086				

[1] No lime appeared in analyses numbers 3, 4 and 5.

[2] No carbonate of lime nor carbonate of magnesia appeared in analyses numbers 2, 3 and 5. Hence in these cases the average of the *two* in which they appear is given.

PLATE V.

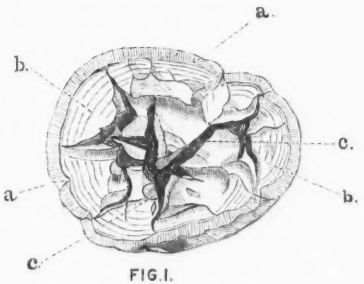


FIG. 1.

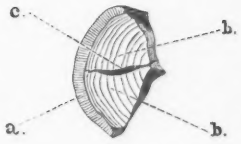


FIG. 2.

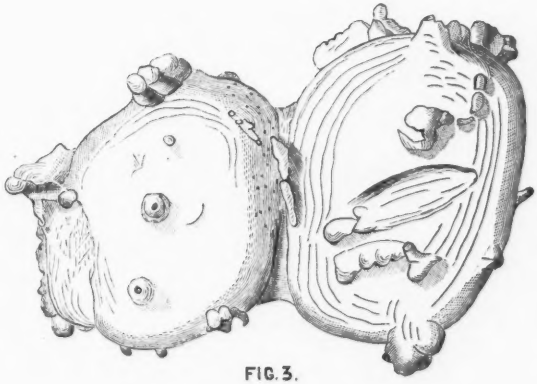
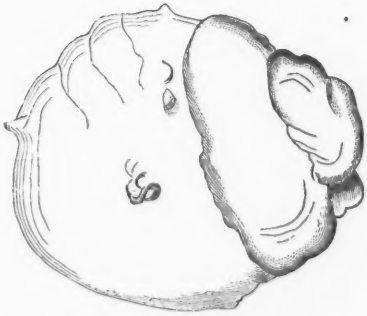


FIG. 3.



A.F. GRAY. DEL.

FIG. 4.

LOESS CONCRETIONS.

The composition of the concretions is essentially the same as that of the loess proper, though some of the elements do not appear therein. After treatment of 100 grains of the interior with strong muriatic acid, there remained, after thorough washing and drying, thirty-one grains of insoluble residue, or nearly one-third, which was plainly silica. Dr. Litton's analyses of concretions from the loess of Missouri, the only ones, I believe, on record in America, gave him :

Residue, insoluble in hydrochloric acid, principally silica	35.08
Alumina and peroxide of iron	5.29
Carbonate of lime	58.33
Carbonate of magnesia	0.77

The absence of a greater amount of carbonaceous material in the loess soil proper is matter of common remark. It may be accounted for, perhaps, by the fact that carbon in the soil tends generally to oxidize and disappear, save where there is an accumulation of water and a cool climate.[1] Its presence in the shape of "organic remains" seems to have been noticed, in chemical manipulations, only by Aughey and Emery, as noted in the table.

Method of Deposition.—The older geologists, without exception, seem to have agreed either upon the fluviatile or lacustrine origin of these famous deposits. Nor does this decision appear to have been questioned until the publication of Von Richthofen's *China*, in which that celebrated geologist elaborated his views, based upon extensive and painstaking study of the loess of that country. His views are radically distinct from those of his predecessors in the same field of investigation. They are based upon a study of the Chinese loess extending over a period of five or six years, while engaged in certain other investigations under the auspices of the Prussian Government. His observations were published at length in the work to which allusion has been made, in 1877, but not having access to the original containing them, I am obliged to formulate a *résumé* of his theory from reviews which have appeared in the several scientific journals. This is deemed necessary for the reason that though based upon the Chinese loess, Richthofen expressly states that in his judgment the theory of that deposit is applicable to the loess wherever on the globe it may be found.

[1] *Vide* Darwin's "Naturalist's Voyage around the World," ed. of 1876, pp. 286, 287. Contains some interesting facts relative to peat formation.

Richthofen holds[1] that the loess is a subaërial accumulation, due to the drifting action of the winds; to transportation by rivulets from the hills immediately adjacent to each loess basin; and to the mineral material left over the basin by the growing grasses and other plants. The material for wind transportation is gathered from the circumjacent or even from remote rocks which were decomposed or disintegrated by alternate changes in temperature or humidity. The plants that covered the great plains served to stop the wind-drifted particles, and thus kept the accumulation ever in progress. Observing certain local differences in the appearance of the deposits which he studied, he invented the distinctions of *land-loess* and *lake-loess*. The last named was designed to account for certain indications of stratification or lamellation not to be adequately explained by the wind theory.[2] The present system of drainage he accounts for much as do most other geologists, the main difference consisting in the assumption of great changes of climate causing heavy rains which led to floods. The usual indication of changes of level are also noticed by him, but they seem to have led to novel interpretation. Von Richthofen states that he found no evidence of a fresh-water *fauna* in the formations he studied, but land forms of molluscous and other animals abounded. In this he is directly opposed by the earlier and original observations of Pumpelly[3] who distinctly states that he found fresh-water

[1] This view was *first* advanced by him in 1870 in a memoir on the geology of the provinces of Honan and Shansi.

[2] *Vide* Am. Jour. of Sci. and Arts, Vol. XIV, p. 490, series third.

[3] *Vide* Smithsonian Contributions to Knowledge, No. 202, pp. 42–43. That this author at that writing was convinced of the fresh-water origin of the Chinese loess is attested by the following language. He says: "That this deposit was formed in fresh water, is shown by the presence of the shells found in the terrace of the Te Hai. The uniform character of the loam in the different basins, and in all parts of the same basin, its great extent, and the fineness of the material of which it consists, are conditions which prove that it is not of a local origin, or derived from the detritus of neighboring shores, but that it was brought into the lakes by one or more large rivers which must have drained an area of great extent. Now throughout the region in question, the only rivers are those of the Yang Ho and Sankang Ho basin, and independently of the fact that these streams drain a very small area, the valley systems of these were almost entirely occupied by the lakes." *Op. cit.*, p. 42.

On p. 43 he derives the following argument from physical geography: "Indeed, all the information we possess concerning this region, goes to show that it has been the basin of a great lake, which once extended from the northern bank of the Yellow river southward to the mountains crowned by the Great Wall." These words were penned eleven years before the work of Richthofen appeared.

forms in the loess regions on the borders of Mongolia. The points, however, which are mainly relied on by the Baron, appear to be (1) the presence of root-marks occurring throughout the formation; (2) absence of fresh-water or other aquatic life-forms; and (3) absence of stratification. Both the second and third of these propositions are met by the repeated statements of numerous careful observers, who have found aquatic and semi-aquatic forms in many localities. The presence of the semi-aquatic forms alone—such as *Succinea*—which are indicative of a moist station, effectually negatives the assumption of a "dry, elevated area swept by fierce winds." The first proposition has been met by the studies of Professor J. E. Todd,[1] who has shown that from the law which evidently obtains, that root-marks vary in frequency inversely as their distance below the present surface, "unusual care is necessary to interpret observations correctly." The conclusion reached by that observer is, that when correctly interpreted the distribution of root-marks opposes the sub-aërial hypothesis.

It will have been observed that the original statements and inferences of Pumpelly and those of Richthofen were distinct and opposed. The former recognized the agency of water alone as sufficient to explain the phenomena he studied, while the latter called to the aid of the winds a lake-basin, which in turn necessitated his artificial distinctions of lake-loess and land-loess. That such a distinction is wholly inapplicable to American deposits—unquestionably true loess—is patent, for the reasons that it presents a perfect homogeneity of structure, entire absence of any such modification as is seen in dunes—such as are true wind structures—and does present at several localities a faintly stratified appearance. Besides, the climatic conditions required by this theory of the Chinese loess, seem to have had no counterpart in climatic changes over the areas covered by our loess.

The argument for the lacustrine origin of the American deposits has been in part anticipated in the foregoing. But there should be added the facts that here the formation is confined to river

[1] Proc. A. A. A. S., 1878, Vol. XXVIII. "Richthofen's Theory of the Loess, in the light of the Deposits of the Missouri." Professor Todd here shows that the lower limit of root-marks—about forty-five feet—is approximately parallel with the present surface. A table accompanies giving the depth of penetration of roots in the loess. Those of the scouring rush (*Equisetum lævigatum* Braun) reached a point more than twenty-five feet beneath the surface.

valleys, and the high lands immediately adjacent; that of the fineness of its material, its composition, its rounded or triturated form, the fossils imbedded in it, and the unmistakable action of water in assorting; that of general continental depression synchronous with its formation; that of the vast quantity of the material and its deposition alike on hill and in valley. These severally and together are fatal to the hypothesis of Von Richthofen.[1] It is nevertheless beyond question that the loess, *after deposition*, has been somewhat modified by the action of strong winds, but the evidences of such action are purely local. The great dust-storms of Western Iowa, extending far beyond the central portions of the State, which occurred in the spring of 1880, will long be remembered in the annals of Iowa. For days the air was filled with fine dust, coming from the south-west, the locality of the greatest areas of loess and the prevailing quarter of the winds. That much of this fine material was carried miles further away I have no doubt. The main effect however, of such wind storms, would be the denudation of the windward, and the deeper covering of the leeward bases and sides of hills.

Fossils.—The mollusks of the loess belong, with perhaps a single exception, to genera which now flourish in regions adjacent to the formation. They are *Limnæa*, *Physa*, *Planorbis*, *Segmentina*, *Pomatiopsis*, *Valvata*, *Amnicola*, *Sphærium*, *Anodonta*, among fresh-water forms, and *Hyalina*, *Stenotrema*, *Helicodiscus*, *Conulus*, *Strobila*, *Helicina*, *Patula*, *Mesodon*, *Vallonia*, *Macrocyclis*, *Pupa*, *Succinea*, *Vertigo*, and *Cionella*, among the land forms. *Unio* is

[1] At the present day the Missouri flows past the western boundary of Iowa at an average rate of five miles per hour (Pacific R. R. Rept., Vol. I, p. 232). The fall per mile of this remarkable river, from the three forks of the Missouri to St. Joseph, varies from 31.59 to .88 feet, with an average for the whole distance of 1.55 + feet per mile. It annually discharges into the Mississippi about four trillions of cubic feet of water, and at the western boundary of Iowa it is not too great an estimate to assume an annual flow of two trillions of cubic feet of water, equaling one-tenth the whole discharge of the Mississippi. (See Humphrey's and Abbott's "Report on the Mississippi River," p. 49.) The amount of sediment *now* being contributed by the Missouri to the Gulf is remarkable. From specimens taken at Council Bluffs at both low and high water, Professor Emery determined the amount in one gallon of the former at fifty-two grains, and in an equal quantity of the latter at 404 grains. That, under the conditions prevailing at the time of the loess deposition, the amount of sediment was *very largely* in excess of these figures, is a fact beyond question, the material being, without doubt, furnished by the grinding of glaciers. These considerations should have their full weight in determining the dynamics of the loess of the Missouri region.

quoted by Drs. Hayden and Aughey from the loess of Nebraska. There are thus, of mollusks, eleven genera attributed to fresh-water, against thirteen genera to land forms. The single exception to varieties now living, as above noted, is *Helicina*, the species meant, *H. occulta* Say, being now extinct.[1] It may be properly considered the only species characteristic of the loess. From the loess of east Central Iowa, at Iowa City, the *chela* of a *Cambarus* is reported,[2] under circumstances which leave no doubt that it is from *true* loess.

Of higher animals there have been found, especially in the Southern States, remains of *Mastodon*, *Megatherium*, *Mylodon*, *Megalonyx*, *Castor*, and *Fiber*, among others. Their remains and the relation of the loess to the drift, which, when both are present, it always covers, places its epoch at the close of the glacial period.

(To be continued.)

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ICHTHYOLOGICAL PAPERS BY GEORGE POWERS DUNBAR, WITH A SKETCH OF HIS LIFE.

BY JACOB L. WORTMAN.

A STUDY of the fishes of the Southern States is one replete with many points of interest for the naturalist, and had it not been for a series of misfortunes, the credit for the earliest research into this field would probably be due to an American student now unknown. It is the object of the present article, to give some information relating to the life and labors of this meritorious naturalist, which are of especial interest, since he was one of the first native-born Americans who made an extended study of the ichthyology of this region. The absence during his time of any periodical devoted to the natural sciences in this country, contributed much to his disadvantage, and as a consequence the technical descriptions were withheld in anticipation of an opportunity to publish. This unfortunate circumstance is one of the causes of his obscurity, and is in part answerable for the loss of his many excellent observations in this branch.

George Powers Dunbar was born in Baltimore, February 11th, 1812. Nothing of unusual interest was noticeable in his early childhood, except an innate love for a study of natural history, on

[1] This statement now needs some modification. Since it was in type, a species of *Helicina* has been sent me in considerable abundance, taken in the vicinity of Iowa City. That they are *H. occulta* Say, is hardly to be doubted. The forms sent all approximate the variety described by Green as *Helicina rubella*.

[2] A. H. Pilsbury, *in litt.*

account of which his parents were doubtful of his future success in life. He entered St. Mary's College, Maryland, at an early age, and graduated from it with high honors in his eighteenth year. The unfavorable outlook that science then presented for a livelihood, induced him to look elsewhere for means of support. Civil engineering was the profession that he chose, and the one that he practiced until his death. Having completed his studies in this branch, he was engaged on a survey of the Baltimore and Ohio, and the Portsmouth and Roanoke railroads from 1829 to 1835, a station on the former line still bears his name. In the early part of 1835, he removed to New Orleans, where he was employed on the Nashville railroad under Major Ranney. He was appointed Engineer of Public Works of the State in 1837, which office he held until 1842, when he was elected surveyor of the second municipality. This last office he retained with the exception of a few months till the time of his death, which occurred on December 29, 1850, at the mouth of the Coatzacoalcos river, Mexico. Although in feeble health, Mr. Dunbar had accepted a position with a corps of engineers, to survey the route for the Tehauntepec railroad, where his health gave way entirely, and he died on shipboard while en route to his home in New Orleans.

At the early age of nine, he began collecting and arranging in systematic order entomological specimens. In the course of a few years his collections on this subject amounted to several thousand specimens, which he afterwards presented to Dr. Luzenburg, of New Orleans. The collection was afterward destroyed for want of proper care. He was likewise familiar with the Flora of the South, and contributed something on the "Flora of the Dismal Swamp." Shortly after leaving college, he began a careful study of the classification, structure and habits of the fishes of the Southern States, which he continued with great zeal up to the time of his death. All the time that could be spared from his professional duties was given to the pursuit of his favorite study, and he had prepared nearly all the plates and texts for an extensive volume which he was intending soon to publish. The volume was to contain descriptions of over one hundred fishes, and was to be profusely illustrated by drawings from life made by himself. His last observations on some of the fishes of the Mexican coast, made a short time previous to his decease, are still in existence and were probably the last that he intended to make before publishing his work. In connection with his sad and untimely death we are

called upon to chronicle another most lamentable fact, the utter destruction of his manuscript by fire at Riesterstown, Maryland, a few years afterwards. His friends intended to publish his work, but deferred publication in the hope that his son would take up the subject and finish what his father had so nobly begun. The son, however, had no inclination for such study, and the publication was too long delayed. The notes above referred to, a small field book containing drawings and descriptions of twenty species of fishes, together with some popular descriptions that were published in various newspapers, are all that remain of his labors in this field. These are the property of his eldest daughter, wife of Dr. W. H. Corbusier, Asst. Surg. U. S. A. Although the subject has been carefully developed by subsequent students, yet our respectful esteem is due to the merits of this pioneer naturalist, whom misfortune has cast into the shadow of obscurity. It is unfortunate in the extreme that death should have cut short his career, and the result of his close and careful observations should have been swept away at a flash. That he possessed true merits is observable by a glance at his remaining notes, which likewise serve to indicate the excellence of his intended publication.

I give some extracts from his MSS. which will prove interesting and novel even to ichthyologists.

I. The Alligator Gar (Litholepis spatula Lac. *Jor.*)—But few of my readers except those who have resided in the South, have an idea of the alligator gar, and for their benefit I will describe this river robber. The body is cylindrical and elongated, and completely enveloped in a strong coat of mail, formed by strongly toothed quadrangular plates lapping over each other, and held by an exceedingly thick and tough skin. The head is elongated, with a flattened obtuse snout, something similar to that of a pike, and armed with several rows of strong pointed and trenchant teeth, the outer row being much larger than the inner ones. The bones of the head are naked, and form a series of stout plates. So hard is the armor with which this fish is enveloped, that no arm, however strong, can penetrate his back with an axe, and it is only by cutting him in his throat or by a blow on the back of the head that he can be killed. They grow to an immense size, being often seen in the waters of the Mississippi twelve or fourteen feet long, and sometimes reaching a weight of several hundred pounds. He is possessed of prodigious strength, and sets at defiance the

efforts of the uninitiated angler, swallowing his hooks by the handful and parting his tackle as if it were pack thread.

This remarkable fish is familiar to almost every resident in the South, and yet but little is known generally of its habits and history. His terrific jaws, his flinty scales, and the extreme difficulty of hooking him, the ease with which he destroys the ordinary tackle used by the angler, added to his worthlessness for the table, render him an object of terror to the fisherman, which added to his fierce and repulsive appearance, is sure to obtain for him, should he by any means fall into his hands, such treatment as his namesake, the alligator, might expect from the huntsman whose dog had been devoured by the monster.

Possessed of an exceedingly ravenous appetite, he snaps at and devours every thing which comes in his reach, and yet there are times when the most dainty morsel will scarcely tempt him. Early in the morning the water is continually broken by him as he rises to seize the floating insects, or small fish swimming upon the surface; but, as the sun ascends, if on the feed, he takes to the deeper water, slowing moving along in search of his prey, and occasionally rising and rolling on the surface in sport. Tired of the chase, he may be seen basking his huge and motionless form in some sunny nook, the shoals of mullet frisking and frollicking around him unheeded. Rapid, current or pool, the clear running spring stream, the sluggish bayou, the pond, or the salt creek, all are familiar to him, but he particularly affects the deep still bayou, or the entrance of some sluggish stream into a bright, clear and dashing current. Stand on the little bar formed by the junction of the last mentioned, and you may see him pass and repass, plunging into the current after a small fish, diving under the rooty bank, and rolling in fun on the top of the dark bayou, and snapping his jaws together, as if the livelong day were only created for him to rollick in. The ringing steel launched from the sturdy arm of the fisherman glances harmlessly from his more than steel-clad body, the river robber rolls his huge form through the deep river, now rising like a porpoise, and now with noiseless movement of a cat swimming slowly to the shallows, stealing along through the bright green leaves of the beautiful nelumbium to surprise the sunny perch or sleeping pike, or suddenly attracted by a passing shoal of sardine or mullet, he dashes like light to their center, his capacious and horrid jaws

wide open and his sinewy tail dealing death on every side. The wary bass retires to his shady nook, and the little patasa dive deeper into their rooty recesses at his approach, and woe betide the unlucky wight who trails his well filled string of bass at the stern of his pirogue; the river robber is sure to attempt a rescue, and well will it be for the angler, as seizure once made, if he have a single fish left, of his morning's sport.

During the months of December and January the fish seek the heads of the still and almost stagnant bayous or the deep caves of the sluggish rivers to deposit their spawn. The eggs are held suspended in a thick gelatinous transparent substance, forming long ropes several inches in diameter, which are hung on old snags, roots or branches of trees that have fallen into the water. The spawn has much the appearance of that of the frog, with the exception of the circular form it assumes, and the size of the eggs, which are about as large as No. 4 shot, and of a dark purple color. The young come forth during the spring, and tiny little rascals they are, but they grow with astonishing rapidity, and by the latter part of August are some fourteen inches in length and weigh several ounces; in one year they reach a weight of from nine to twelve pounds, and go on increasing to several hundreds. Large numbers of these fry are destroyed by other fish, and well that it is so, otherwise no fish could live in any of the rivers for them, the ovaries of a large fish containing several hundred thousand eggs.

Well skilled are ye, my piscatory brethren of the North, in the art of killing trout and salmon, rock and pickerel, and truly you have beautiful customers to deal with, but I would put you with your Conroy's and your plaited silk, at a sixty pound Poipon D'Armèe, and in an hour you would be hookless, lineless and rodless, and only have for satisfaction that you had seen the lazy hulk roll his huge form in sport over the surface. Few of you would come off victorious in your first day, but when you became acquainted with your customer, and learned the necessary rigging, then would the armed monster repent of his appetite for mullet or sardine.

Although I have taken many small gar, from twenty to thirty pounds, with a light fly rod and a single gut, yet I never fish for them with such tackle, for where you succeed in striking one in a tender place and beyond the reach of his tremendous jaws, you

will break your gut a hundred times. No! I go upon the safe, the sure principle of saving my fish, and I use tackle accordingly. My ash and hickory (I cannot yet boast a Conroy, but I will soon) are laid aside, and a three-joint cane, with a stout tip substituted in their place; instead of rings my line passes through small beckets *on top of* the rod and over a roller at the tip. My line is generally manilla or sea grass of fine size. I prefer it as such a large quantity can be placed upon the reel. But the main point is the arrangement of the hooks, which is as follows: A brass or copper wire about four inches long with an eye at one end holds the bait hook. The line is made fast to a double wire passing through this eye and bent outwards, with two stout sharp hooks to each end with their points inwards, so that the fish when he takes the bait must have his throat directly above them. When the bait is taken, a strong strike is made and the consequence is that the gentleman has the hooks driven deep into either side of his throat.

The bait is overboard and every one waiting anxiously to see the "gar killer" strike his fish. The blue float slowly moves off and gradually sinks; he's there. Quietly the line is paid from the reel until he has gone some thirty feet. The hooks are driven home, the cane bends to the pressure but the line does not move. "You're fast to a log," cries one who never saw a gar. The line is slacked—another strike; another—he feels the steel and off he goes. Now for it! Full well does the gar killer know the exact pressure which his tackle will bear, and as well does he know that he can conquer only by making his prey fight and struggle for every inch of line. He whips him to his work, and now the robber has thrown off all his lethargy and tries every art, lays out all his strength to rid himself of the toils—beware his rush, for salmon or rock never came near it. Whiz goes the reel; twenty yards are gone, and you have him. Now comes the struggle and the angler is victorious, his head is turned, and rapidly comes the line to the reel. Half an hour is gone and yet his form has not been seen. Do you see the line slowly ascending? Watch him well, 'tis his last attempt—defeat him and he is safe. Slowly the white line leaves the water. Now faster the spray is thrown far and wide, and high in the air leaps the victim, hoping by his huge weight to break the tackle. Down goes the tip, the line is slack as he leaves the water, and his last

attempt is abortive. Weaker and weaker are his struggles; he rolls and tumbles in the water as he is slowly drawn up; the gaff is in his gills; one haul, and he's beached.

II. The Grande Ecaillé (Megalops thrissoides Bl).—In shape the head of the grand ecaillé is similar to the shad, but his mouth is much larger in proportion to the size of the fish, and his body is covered with large splendid silver scales, fitting like plated armor; those of a fish five feet long being about two inches in diameter, and showing at each intersection about a quarter moon. His tail is large, broad and stout, and he sometimes grows to a length of eight and a-half or nine feet, but generally runs from three to seven. I record the killing a grand ecaillé with a rod and reel as the greatest piscatorial feat I ever performed, which is saying a good deal after successfully playing and killing two fish, each over twenty-five pounds, with two rods and reels at the same time. I could never have killed the grand ecaillé, however, with the tackle I used, had I not been in a pirogue with a sure and steady arm at the paddle, which gave me the advantage of running on him.

In point of beauty, activity and strength, the grand ecaillé is excelled by none of the finny tribe which have come under my observation. He belongs to the same family with the shad, herring, etc., and is the king of his tribe. He scorns the seine, and generally puts at defiance the efforts of the angler. Calmly he swims around the netted prison, seeking quietly to escape from the toils, but finds no outlet, with a quiet turn of the tail he goes slowly back to the center of the net—swiftly flies the foam from his vigorous tail; with one long sweeping, graceful bound, high above the floating corks he passes, and plunges with the grace and ease of an accomplished diver, head foremost into the green wave beyond; or if by chance he becomes entangled in the bag, he gathers his immense strength together, and like the tiger springing on his prey, he rushes at the end of the bag, the corks quiver for a second, and the next instant sees the silvery meteor passing like a ray of light through the atmosphere, he quivers his broad forked tail in triumph, and laughing at the weak net, goes on his way rejoicing. See him struck by the hand line of the sturdy coastman; every inch of line is given to him and the fisherman braces himself for the pull; well for him that his hands are hard; the moment he finds himself checked in his rush, he

leaves the water and springs some ten feet into the air, shaking himself violently with the hope of casting off the hook, which he will do unless it is firmly fixed deep in his mouth, or tear off his jaw in the attempt. Another leap, another and another, with all the frenzy of the wild horse when he first feels the lasso, he springs through the air and dashes through the water; for a time there appears to be no diminution of his immense strength, but you may notice that after a while the long curve he at first described in the air becomes broken, shorter grow the graceful leaps, and finally change into a violent jerking summersault—then all is calm. The fisherman pulls on the line; one last glorious effort of those splendid powers is made—right in a line with and towards the fisherman; the grande ecaillé takes his last leap, and falls helpless into the sea. Now a child can take him without resistance—no struggling, a dead weight upon the line, he is hauled upon the beach. He flounces not, his fins are laid to his body, his gill covers do not move, he is dead! And not until death came upon him did the mighty and beautiful creature surrender himself to the superior robber.

I have often seen a school of red fish knocking the mullet into the air. I have seen troops of flying fish retreating from the lovely dolphin, I have heard for miles the roar of an immense company of mullet flying in short, regular leaps before a herd of porpoises, or a family of sharks, by whose giant forms I have seen the sea beaten into bubbles, as they lashed and struck among the frightened mullet, from my boyhood up. I have seen man prey upon his fellow-man, but never has it fallen to my lot to witness so magnificent a sight of the strong preying upon the weak as that presented by the grand ecailles. The yellow rays of the setting sun would glance upon the silver armor of a thousand forms leaping in every possible direction, crossing and recrossing, yet never striking, the air was filled with the small sardine thrown from their native element to be devoured as they touched the water, the green gulf was lashed into a sea of foam, and the bright rainbows were everywhere visible in the scene. We passed through them many times, hoping that one might leap into the boat, caught them by the tails as they swam slowly by, and cursed our lot that we had brought no harpoon. It was a brilliant sight—one which in all probability had not been seen on so grand a scale before, as they rarely run more than three or four together, and one which it may be my lot never to witness again.

PROBLEMS FOR ZOOLOGISTS.

BY J. S. KINGSLEY.

MR. S. H. Scudder in his address before the Entomological Section at the Boston meeting of the American Association for the Advancement of Science, presented some of the problems which the entomologist has yet to solve, and acting upon the hint which his article affords, I would here state some of the questions in other departments of zoölogy which are as yet unanswered. Throughout our land there are several hundred people who are greatly interested in zoölogy, but the greater portion of them through lack of guidance and through misdirected efforts, add nothing to the stock of scientific knowledge which the world possesses. On the shoulders of a few falls all of the original investigation done in America to-day. It is to that larger class who are willing to work, but who do not know how to work, or what to work upon, that this article is addressed. Some of the problems are simple, needing only a slight amount of experience, and a moderate amount of skill, while others require for their elucidation the trained investigator. To state all the problems requiring solution, would take more space than is contained in a volume of this magazine; a few only, therefore, are presented.

Hermann Fol has recently described the effects produced upon the eggs of star-fishes when two or more spermatozoa enter it at the same time. An abnormal segmentation ensues, proceeding from two or more centers, and resulting in a compound gastrula. This would suggest a possible explanation of the cause of double monsters, and assign an answer for a much vexed question in teratology. A single fact is but a slender foundation for generalizations of this character, and hence observations are needed to ascertain whether in other groups a multiple impregnation produces a compound gastrula, and if so, what the gastrula in turn produces.

The eggs of a few animals have been studied while becoming mature, and when the impregnation was taking place, and with wonderful results. Yet but a very few forms have thus been studied, and detailed accounts of the phenomena of the maturation and impregnation of eggs are needed in almost every group. The eggs of the larger proportion of the animal kingdom in becoming mature form what are known as polar globules. With the possible exception noted by Grobben, these polar globules

have not been found in the eggs of insects and crustacea, but our information on this point is still of a negative character, and new and careful investigation may conclusively show that the Arthropoda in this respect do not form an exception to the rule that the extrusion of polar globules is one of the features of the maturation of the eggs of all animals.

Grobben when studying the development of a small fresh-water crustacean *(Moina)*, found that certain cells, which eventually formed the genital organs, were differentiated at nearly the same time as the epiblast and hypoblast. Metchnikow has also found in an insect that the reproductive organs were very early developed. When we consider that the chief end and purpose of every animal is the reproduction of its kind, this early appearance of the genital organs is what should be expected, but as yet, so far as I am aware, these two observations stand alone. Here is possibly a fruitful field for some ardent student.

In the waters of the whole eastern United States (with the exception of New England), and the Mississippi basin, are to be found representatives of a family of Mollusca peculiar to the American continent, the Strepomatidæ (Melanians). Of this family numerous genera and many hundred nominal species have been described, but as yet we know nothing of their embryology and but little of their anatomy. With the exception of a paper on the structure of two genera by the late Dr. Stimpson, a few short notes is the sum total of our knowledge of true "soft parts." We cordially commend the investigation of the "Melanians" to the naturalists of the Mississippi basin.

The fauna of the United States is exceedingly rich in Urodelous Batrachia, and a fine field is open for a *comparative* study of their visceral anatomy and their myology. Their osteology, however, has been pretty carefully studied, though the results are not yet published in full. European embryologists have confined their studies of the development of the Batrachia to the tailless forms, while Dr. Clark is the only American who has contributed anything of any extent to our knowledge of the life history of the salamander,[1] and his observations are principally on the external changes.

The calf fish *(Amia)* of the Western rivers is a representative of

[1] The observations of Scott and Osborn should not be overlooked, though published in England.

a group of fishes of whose development almost nothing is known, and a detailed account of its embryology would have an interest and importance only excelled among the vertebrates by that of *Ceratodus*. The gar pike's development has only been studied by Mr. Agassiz, and his observations are very incomplete, though very important. A study of the development of any of the *Amiuridæ* (cat fish and horned pouts) would be very interesting and instructive, and would amply repay the person who will undertake it, while the man who investigates the method of growth of *Myxine*, so common at Eastport, will have an entirely unexplored field to himself.

The problems which we have stated are almost entirely embryological, and it is in this line of development that the most important results are to be reached. A future article will present more of the anatomical side.

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RECENT LITERATURE.

THE ZOOLOGICAL RECORD FOR 1880.[1]—This volume, the seventeenth of the series, has appeared with commendable promptness, and Mr. Rye, the editor, assures us that this rate of issue will henceforth be maintained. The recorders of the different departments are nearly the same as in the preceding volume.

It appears that the number of new genera and sub-genera contained in the present volume is 1008, as against 976 of Vol. XVI (which contained sixty new genera of *Arachnida*, properly belonging to Vol. XV, from which that group had been omitted). These are divided as follows: Mammalia, 34; Aves, 16; Reptilia, 216; Pisces, 31; Mollusca and Molluscoida, 79; Crustacea, 80; Arachnida, 78; Myriopoda, 2; Insecta, 438; Vermes, 28; Echinodermata, 24; Cœlenterata, 70; Spongida, 51; and Protozoa, 56.

The number of pages is about the same as in the preceding volume. On p. 3, Myriopoda, we notice an important error. Mr. Ryder's order *Symphyla* is spelled *Symphuta*, the name not being repeated in the note under the heading thus misspelled.

This record is of the greatest service to the systematic zoölogist, and to none more than those who are unfortunate enough not to be within reach of large libraries. Hence the American zoölogist needs the "Record," if he has no other works.

THE FISH FAUNA OF BORNEO.[2]—In Vol. XVI of the Annals of the Genoa Museum of Natural History, D. Vinciguerra com-

[1] *The Record of Zoological Literature.* London. Van Voorst. 1881. 8vo.

[2] *Annali del Museo Civico di Storia Naturale di Genova.* Vol. XVI. D. VINCIGUERRA. Appanti ittiologici sulle collezioni de Museo Civico di Genova IV. Prima contribuzione alla Fauna Ittiologica di Borneo, pp. 161–182.

mences the publication of the results of the examination of a rich collection of fishes made by the Marquis Giacomo Doria and Dr. Odoardo Beccari during their residence at Sarawak.

Eighteen species of Siluroids, two of them new to science, and two others not before known to occur in Borneo are described; raising, with six species enumerated by E. Von Martens in the Zoölogy of the Prussian Expedition to Eastern Asia, the total number of known Bornean siluroids to fifty-eight.

The writer remarks that he finds many new species in this collection, and that this may be expected from the fact that, except Bleeker, few naturalists have collected the fishes of the island.

H. Schlegel, S. Müller, and J. Richardson had noted only ten Bornean species before the time of Bleeker, who, examining the collections made by Dutch government officials, raised the number to three hundred and forty, all of which were from few localities.

Since that date the only additions to our ichthyological knowledge of Borneo have been the description by Dr. A. Günther of two species of Gobiidæ, which formed part of the Doria collection, and the chapter by Martens on ninety-four species of freshwater fishes from the rivers Kapuas and Sambas.

MARK'S MATURATION, FECUNDATION AND SEGMENTATION OF LIMAX.[1]—This work is very timely, and is valuable, both from the original facts it contains regarding the intricate subject of the preparation of the egg of the slug for fertilization, as well as the latter process, and the mode of segmentation, which is of great value from the detailed exposition for the English-reading student of a department of embryology which has been mapped out mainly by German embryologists.

The author first gives us his own original observations, illustrated by five excellent double plates, and then presents us with a lengthy discussion and review of all the papers and works which have been published on the earliest phases of embryonic development above enumerated.

In the third part, Dr. Mark presents theoretical considerations and general conclusions regarding the promorphology of the ovum, polar phenomena, asters, spiral asters, the nuclear spindle, origin of nuclei, the germinative vesicle and polar globules. The appearance of such a profound, critical summary of what is known on these points, should give a stimulus to those studies in this country. The treatment of the subject by the author is clear, candid, and the matter well digested and elaborated.

GENTRY'S NESTS AND EGGS.[2]—It is hard to say whether we look upon these beautiful colored lithographs, representing the nests

[1] *Bulletin of the Museum of Comparative Zoölogy at Harvard College*, Vol. VI, No. 12. Maturation, Fecundation and Segmentation of *Limax campestris* Binney. By E. L. MARK, Cambridge, Oct., 1881. 8vo, pp. 173–625. 5 plates.

[2] *Illustrations of the Nests and Eggs of Birds of the United States.* J. A. Wagenseller, 23 N. Sixth street, Philadelphia.

and eggs of birds, or upon similar representations of the birds in other works of the kind, with the most pleasure. Illustrations of the nests and eggs, however, are more rare and proportionally more interesting.

We have now in the twenty-one parts already issued, representations of the nests and eggs of the cedar bird, the wood pewee, the cat bird, the orchard oriole, the kingbird, the red-wing blackbird, the humming-bird and towhee bunting, or chewink, also of the screech owl, the wild turkey, the tit, the auk, the killdeer plover, the chimney bird, the crow blackbird and many others. In the plate containing the humming-bird's nest and eggs, the male and female birds are also represented, forming a very beautiful picture. The nest is made "of vegetable wool from the poplar and oak, and is lined with a few small white feathers. Externally there is a dense covering of bluish crustaceous lichens and brownish oak tassels, which are held in position by saliva and strands of spider's silk. It was placed upon a branch of the beech tree, at an elevation of twenty feet from the ground. In height it measures one and three-fourth inches, in external diameter one and a half. The width of the cavity is three-fourths of an inch, and the depth about one-half."

The nest of the towhee bunting, or chewink, is described by Mr. Gentry as always placed upon the ground, usually half covered and concealed by long grasses that surround it. The author says, "When placed within a thicket, or on the borders of it, the nest is either built in a depression of the ground, usually beneath a bunch of grass, in a pile of old brush or faggots, or on a slight prominence surrounded by tall, graceful ferns."

The figures of the crow blackbird, Maryland yellow-throat, the killdeer and the red-throated loon, are especially good. This excellence is partly due to the skill of the able zoölogical artist Edwin Sheppard.

We take this opportunity to recommend this elegant work for every library.

RECENT BOOKS AND PAMPHLETS.—Statistics of the Iron and Steel production of the United States. Compiled by James M. Swank. 4to, pp. 180, maps, cuts, Department of the Interior. Tenth Census of the United States. Government Printing Office, Washington, 1881. From the department.

Palæontological Bulletin, No. 34. Contributions to the history of the Vertebrata of the Lower Eocene of Wyoming and New Mexico, made during 1881. By E. D. Cope. 8vo, pp. 60, map. (Ext. Am. Phil. Soc.) Philadelphia, 1882. From the author.

The Distribution of Plant Life, and the agencies contributing to it. An address delivered before the Maryland Horticultural Society at its April meeting, 1881. By Dr. Bolling W. Barton. Roy. 8vo, pp. 8. Baltimore, 1881. From the author.

Eels (Anguilla acutirostis). By William Hosea Ballou. 4to, pp. 2, cuts. Jan. Am. Field. Chicago, 1882. From the author.

On the variability of the Acorns of Quercus macrocarpa Michx. By Joseph F. James. 8vo, pp. 4, 1 plate. Ext. from the Journal of the Cincinnati Society of Natural History. Cincinnati, 1882. From the author.

The Domain of Physiology, or Nature in thought and language. By T. Sterry Hunt, LL.D. 8vo, pp. 27. Boston, 1882. From the author.

A Revision of the Cis-Mississippi Tertiary Pectens of the United States, pp. 16. Remarks on the Molluscan genera Hippagus, Verticordia and Pecchiolia, pp. 12. Note on the approximate position of the Eocene deposits of Maryland. By Angelo Heilprin. pp. 6. Proceedings of the Academy of Natural Sciences of Philadelphia. Philadelphia, 1882. From the author.

Proceedings of the United States National Museum. Washington, 1882.

The tailed Amphibians, including the Cæcilians. A thesis, presented to the Faculty of the Michigan University. By W. H. Smith. 12mo, pp. 158, bound. Detroit, 1877.

A case of Polymely in Batrachia. By J. S. Kingsley. 8vo, pp. 8, plate. Ext. from the Proceeding of the Boston Society of Natural History. Boston, 1881. From the author.

The Winter Birds of Minnesota. By T. S. Roberts. 8vo, pp. 10. Extract from the Ninth Report of the Geological and Natural History Survey of Minnesota, for the year 1880. Minneapolis, 1880. From the author.

Transactions of the American Institute of Mining Engineers.

Geological Relations of the Limestone belt of Westchester county, New York. By James D. Dana. 8vo, pp. 80, plate, maps, cuts. Extract from the American Journal of Science. New Haven, 1881. From the author.

Beiträge zur Paläontologie Oesterreich-ungarns und des Orients. Herausgegeben von E. v. Mojsisovics und M. Neumayr. Vol. I, Part I and II, 4to, pp. 70, 13 plates. Wien, Jan., 1882. From the publishers.

Die Stegocephalen aus den Rothliegenden des Plauerschen Grundes bei Dresden. Von Hermann Credner in Leipzig. Vol. II, 8vo, pp. 32, 2 plates. Berlin, 1881. From the author.

Die fossilen Saurier in dem Kalke des Rothliegenden von Niederhässlich im Plauerschen Grunde bei Dresden. Dr. H. B. Geinitz und Dr. J. Deichüller. 8vo, pp. 2. (Extract from) Mineralogisch-geologisches und prähistorisches Museum in Dresden, 1882. Dresden, 1882. From the authors.

Anatomische Notizen uber Heloderma horridum Wiegm. Von Dr. J. G. Fischer in Hamburg. 8vo, pp, 16, plate. Hamburg, 1882. From the author.

Une Page de L'Historie D'une Beleie ou La Catologie il y Cinquante ans. Discours prononcé a la Seance publique de la Classe des Sciences. Par M.P.-J. Van-Beneden. 8vo, pp. 34, plate. Brussels, 1882. From the author.

Liste des Membres de la Société Géologique de France, au 1re Fevrier, 1882. 8vo, pp. 32. Paris, 1882. From the society.

Ottawa Field-Naturalists' Club, 1879–80. Transactions No. 1, 8vo, pp. 64. plate, 1880–81. Transactions No. 2. 8vo, pp. 44, plate, with the address of President Fletcher. Ottowa, Canada. From the president.

The Scientific Roll and Magazine of Systematized Notes, conducted by Alexander Ramsey, F.S.S. Climate, Vol. I, 8vo, pp. 40. London, Feb., 1882. From the conductor.

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GENERAL NOTES.

BOTANY.[1]

THE STUDY OF LICHENS IN NORTH AMERICA.—The interesting plants which botanists term lichens, but which the non-botanical are wont to call "mosses" or "tree mosses," those greenish-gray or grayish-green, sometimes blackish or brownish, growths on bark, boards, rails and rocks are likely to acquire a new interest, and to be much more studied than they have been heretofore.

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

As microscopes become cheaper and less cumbersome, and as information as to the general structure of lichens becomes more available, many students will turn their attention to these curious products of the vegetable kingdom. Indeed, few of the thallophytes recommend themselves in as many ways to the laboratory worker as do the lichens. Their curious dual structure, their colorless filaments (hyphæ), contrasting strongly with the roundish green cells (gonidia), will alone furnish material for much close observation, and if the student permits himself to inquire as to the theories of Schwendener, and Minks, he need have no fears of speedily exhausting the study. Then, too, the various forms of fruiting, the differences in the spores and spore-sacs (asci) with the development of the latter may well claim the prolonged attention of the student.

As a most important aid to the study of the lichens we have now the first part of the long promised "Synopsis of the North American Lichens,"[1] from the hand of Professor Edward Tuckerman, than whom no one is better able to write upon this subject. Long ago (in 1848), Professor Tuckerman gave us a little book, now rare, "A Synopsis of the Lichenes of New England, the other Northern States, and British America," and in 1872 his "Genera Lichenum; an Arrangement of the North American Lichens." We now have Part I of what will doubtless be for many years the standard manual of our lichens. The work being the result of the author's life-long studies, we may reasonably look for much of stability in the arrangement, and in the limits he has assigned to species, genera, and other groupings. Indeed, we notice but few changes in comparing this work with "Genera Lichenum," and these are all of minor importance.

The method of the book leaves nothing to be desired, the specific descriptions being full, and very carefully written. The separation of the species into tribes or sub-genera is equally well done, and the student must be dull indeed who cannot readily follow the author. The key to the arrangement, which precedes the descriptive portion, includes all the genera of North American lichens, seventy-two in number, while this part of the work treats of but forty-three of these.

It may be interesting to note what the author has to say upon several questions which have been under discussion in botany. As to their relationship we find (p. v), "The lowest divisions of vegetable life may still be recognized as Algæ, Lichenes, and Fungi; and conveniently associated together under the designation of Thallophytes; * * * * and there is no doubt, notwithstanding the numerous and now startling discrepancies of these vast groups, that they stand in close natural relations to

[1] A Synopsis of the North American Lichens. Part I, comprising the Parmeliacei, Cladoniei, and Cœnogoniei; by Edward Tuckerman, M. A., author of Genera Lichenum. Boston: S. E. Cassino, Publisher. 1882.

each other. Lichenes are reckoned as intermediate between the other two classes of Thallophytes; but all the limits are uncertain." As to the now famous question regarding the autonomy of lichens, after describing hyphæ and gonidia, we find (p. vi.) "But we are not quite at liberty to stop here. The marked contrast of hypha and gonidium was open to a hypothetical explanation, based on the apparent relations of these organs to what seemed the same in other classes of Thallophytes, which suggested and had its exemplification in the memorable labor of Schwendener. This was met, however, by lichenologists in a manner and tone often ill enough corresponding with the simply objective position of the other side; and there was room for further investigation. Ideally, from the point of view of those who look at lichens as autonomous, the primordial cell should be referable either to hypha or gonidium; but, in fact, as well emphasized by Minks, it is its dualism which, from the beginning of our knowledge, and through all its extent, characterizes the lichen structure, and determines its history. Yet this is not all. The penetrating glance of the cited vegetable anatomist has demonstrated the existence of a third element. Behind and before the manifestation of the hyphæ, which are to play so great a part in the lichen world, is a dimly seen, primordial tissue, a web or net-work of exceedingly delicate filaments (*Hyphema* Minks), which gradually pass into the hyphæ proper, as these accomplish their highest result in generating the gonimous cells."

On the terms Annual and Biennial.—There is certainly much ambiguity in the terms annual and biennial. Those plants which germinate in the spring and die in the autumn are not very different from those which vegetate in the summer or autumn, and flower and die in the succeeding spring or summer; nor indeed can I see much between them and plants like Agave, which live in a barren state for many years, and then flower once and die. It seems to be only a question of the time required to concentrate the requisite energy to produce flowers and fruit. True annual plants may be divided into winter annuals and summer annuals. The former usually store up nutritive matter in the autumn to supply the flowering state in the spring; differing in this from summer annuals. But this is not constantly the case. The Agave is many years doing this. Although this plant flowers only once, we of course ought to have a term to distinguish it from the annuals. There are also the plants which produce stoles rooting at the end, such as the sympodes of Fragaria; in that case the plants are truly perennial. But see such plants as Epilobium, where the buds at the end of stoles alone remain alive during the winter, and produce the plants of the succeeding year: what are we to call these? We usually denominate them perennial. Then how separate them from those which are not aërial, but go through the same course? Then come such plants

as Orchis, where a new tuber is formed by the side of the old one each year, usually at a very short distance from it, but sometimes at some considerable distance, as in Herminium; and the tuber which has flowered dies. The tuber is therefore a winter annual. Of course all these ought not to be confounded with the true perennials, where the same root lives and flowers at least several years in succession. DeCandolle's terms *mono-* and *poly-carpic* will not do, for they convey another idea. *Mono-* and *poly-tocous*, as suggested by A. Gray, are better, but here we do not distinguish between Agave and Brassica. And he has not attempted to distinguish these from Orchis (except by calling the latter perennial, as we all do), or Orchis from Fragaria.—*C. C. Babbington in Jour. of Botany.*

A Botanist's Trip to "The Aroostook." No. 2.—On June 6th, '81, my Western friend and I left Orono (Penobscot county) for Northern Maine, by way of the railroad as far as Mattawamkeag, where we passed a day pleasantly in following the banks of the river for flowers. On the stream of the same name I saw for the first time *Alnus viridis*, which afterwards became a daily occurrence; also *Cratægus coccinea*, with three of its forms; *pyrifolia* and *mollis* being quite abundant, as I found in September, when the fruit had matured. We traveled by stage to Patten (still Penobscot county), a distance of 38 miles through a most delightful country, but saw no new weeds by the roadside. At this place I procured seven of the plants, which were gathered on the Aroostook river the previous year in fruit. Perhaps this locality may be called the boundary line of some of these plants, as they do not grow either at Orono or Mattawamkeag (in writing this article I shall only speak of what I saw), but at Patten they were abundant. One morning we came across a large number of Cypripediums, among which was a purple *acaule* with two perfect flowers growing back to back. The greater part of them were pure white with yellow-green sepals and petals. After a week spent there, taking with us 16 new sketches and a large package of pressed plants, we staged it to Ashland, a ride of 48 miles. The beauty of the country beggars description. For a distance of 12 miles we were in full view of Mounts Ktaadn, Double and Round Top. A good-natured driver told us the names of all the hills, streams and ponds. It may seem strange to the reader that we discovered no new plants in this long ride, but the only novelty spied was a rose-pink *Viburnum lantanoides. Amelanchier Canadensis* vars. *rotundifolia* and *oligocarpa* were abundant but not new, neither were any of the shrubs. *Taxus baccata* var. *Canadensis* is quite common, but straggling and partially dead. *Acer Pennsylvanicum* and *spicatum* is the prevailing underbrush in many of the forests. But for our own voices the stillness would have been oppressive; for a distance of many miles that day we did not find an opening. The mail agent said that between us and Canada on

one side there was probably no house to be found. In one plantation through which we passed there were but two families living. There were but few houses along the road, yet one might almost believe that a village would spring up some time in this untrodden wilderness, whose tangled undergrowth makes it almost impenetrable. The forests often look black with the *Abies nigra* ("Black growth") and the dead trees are oftentimes covered with long green moss. We passed several cabins which are occupied by the lumbermen during the winter months. Ashland is a small, "finished" village, situated on the Aroostook river. The people whom we met there are hospitable and refined. I added *Arabis perfoliata*, *Rosa nitida*, and *Prunus pumila* to my list; also learned through Mrs. G. D. that *Trillium album* grows on their farm, but I was too late to procure it. This immediate region is said to be rich in minerals. After another week profitably spent, we took passage for Fort Kent, 48 miles due north, by a corduroy road. The first day we passed at Portage Lake, a famous resort of fishermen. We gathered some Potamogetons of great size, but they were not in flower, and the day was productive of pleasure alone. For miles the forests were burned and still smouldering, the work of careless gunners, it is supposed. A dismal swamp, indeed! The two fire-weeds, *Erechthites hieracifolia* and *Epilobium angustifolium*, are found here as elsewhere on burnt ground, although I have been told that the first named had never been found in the county; but it is quite abundant on the line of the railroad. The country is decidedly mountainous; the one, two and three mile hills would have been decidedly monotonous but for the lovely foliage and the frolicking brooks. In many places the road was "repaired," and the ditches at the sides were frightful for hypersensitive nerves to contemplate. Eagle lake was the great feature of the ride, it lays along the route for a distance of 5½ miles. No part of the journey furnished excitement until the driver took his pistol out to load it, saying that he should have done so before starting; that he had been fired upon twice in two years, and might need to use it before reaching Fort Kent. He also stated that a peddler who had left this place by that road was never heard from and that his bones were probably bleaching in the woods somewhere. Although we were on the *qui vive* all the afternoon, we only saw the enemy, for whom he had prepared, quietly standing in their doorways looking as demure as possible. At 9.30 Saturday night we found ourselves in Major D.'s hospitable home, 200 miles due north of Bangor. Fort Kent may be called properly a French town. It is situated on the Fish river (its original name), which empties into the St. John river at this place. Nature has done much for this section of the State. The scenery is fine, the air is cool, and the people seem as happy twenty-two miles removed from a railroad (Edmundston, on the Canada side, being the nearest point), telegraph, doctor or drug store as

those do who have all the advantages of hourly intercourse with the world. It is a healthy place also, and the people welcome strangers to their midst with the characteristic hospitality of the county. Space will not admit of the list of plants made here, but the more rare ones were *Pyrola rotundifolia* and *secunda*, with their lovely varieties; also *P. minor*, *Vaccinium cæspitosum*, *V. uliginosum*, *Clematis verticillaris* (Mr. Niles), and *Pyrus sambucifolia*. The swamps at this place afford several orchids; these dark, damp places are favorable to this family of plants. *Habenaria orbiculata* often grows two feet high, with leaves seven by nine inches; *H. viridis* also very large. *H. obtusata* and *Listera convallarioides* abound here. It is hard work to procure them, requiring many a tumble and scratch, and the thought must often come to the mind of the most practical, Does it pay? Why all this toil for "weeds" which have little beauty save to the eye of the botanist? Yes, it does pay; our natures evermore grow young among the primitive pines. The scenery is wild and the silence oppressive. Some of the swamps seem like ponds filled with trees; the fallen ones often form pens, and how to get along, though armed to the teeth with waterproof and rubber boots, one does not know always. Suffice it to say that people who care to visit such places find their way out of them feeling well paid for the trouble. It is interesting to trace the outlines of large trees in the primitive woods. Some have a little bark left, while in other cases there is merely an outline of green or brownish dust. "How old are you?" I asked, half frightened at the sound of my own voice. I did not see a snake either year, and the squirrels and birds did not seem startled, as they do elsewhere. There are but few flowers in the pathless woods; many a hard day's work was lost in search of plants in the primitive forests, but in the "clearings" they are more abundant. The banks of the rivers and ponds furnish more still. St. Francis, 18 miles further up the St. John river, afforded me a white form of *Prunus Pennsylvanica*, *Rhinanthus Crista-galli*, *Euphorbia helioscopia*, *Potentilla frigida*, *Gentiana Andrewsii*, *Juncus Vaseyi*, *Graphephorum melicoidis*, and *Triticum repens*. The small islands in this neighborhood are rich in interesting work. On the way "out" in September I gathered *Goodyera Menziesii* and *Botrychium lanceolatum*; at another place *B. simplex* was abundant, and at Houlton *Lappa officinalis* vars. *major* and *tomentosa*. The former grows five feet high and the lowest leaves often measure more than 18 inches across. These are but few of the many interesting plants which grow in this fascinating county. Go and see.—*Kate Furbish.*

Botanical Notes.—J. C. Arthur in Vol. III of the Proceedings of the Davenport Academy of Sciences, publishes "Contributions to the Flora of Iowa, No. IV," in which he adds forty-three native and six introduced species to his previous lists. Descriptions are given of such as are not found in Gray's

Manual, viz: *Artemisia serrata* Nutt., *Senecio lugens*, Rich., var. *Hookeri* Eaton, *Plantago Rugelii* Decaisne, *Gerardia tenuifolia* Vahl., var. *macrophylla* Benth., *Cuscuta Gronovii* Wild., var. *latifolia* Engelm., *Polygonum Muhlenbergii* Watson, *Aristida purpurea* Nutt.——F. A. Mansfield has compiled a list of plants (137 species and varieties) "discovered in Maine, chiefly since the publication in 1868 of the 'Portland Catalogue of Maine Plants.'"——N. L. Britton has issued a circular of "Notes" for the guidance of those who have the "Preliminary Catalogue of the Flora of New Jersey." Attention is directed to many doubtful natives, and difficult species, and also to the common names of plants.——"The Index to the genus Carex of Gray's Manual," by Jos. F. James, issued as an extra in the *Botanical Gazette*, will prove very useful to all students of that large genus.——The list of New Mexico and Arizona plants collected by H. H. Rusby, contains many interesting species. Sets of these are offered for sale by the collector at Franklin, N. J. ——The February numbers of our botanical journals are full of interest. N. L. Britton in the *Torrey Bulletin* describes and figures (three fine colored plates) a new hybrid oak, between *Quercus Phellos* and *Q. nigra*, and which he names *Q. Rudkini.* E. L. Greene describes six new Compositæ, mostly Californian; J. B. Ellis describes sixteen new species of fungi mostly from New Jersey; and G. E. Davenport contributes interesting "Fern Notes," in which he gives reasons for suspecting *Asplenium ebenoides* to be a hybrid between *Camptosorus rhizophyllus* and *Asplenium ebeneum.*——Dr. Engleman's "Notes on Yucca," in the *Botanical Gazette* include the description of a new species, *Y. elata*, from the deserts of Arizona. L. M. Underwood brings together in an alphabetically arranged catalogue the genera and species of North American Hepaticæ. It includes forty-nine genera, 219 species and seventeen varieties.——In Jos. F. James's paper on "The Variability of the Acorns of *Quercus macrocarpa*, in the Jour. Cinn. Soc. Nat. Hist., the author brings out to a remarkable degree the variable character of the acorn of our common bur-oak. "There are all gradations from no fringe at all on the cup, to one which has a fringe half an inch long. The cups are shallow to deep, thick to thin, extending half way up the acorn, reaching to its apex, or almost entirely concealing it." Eight figures accompany the paper.

ZOÖLOGY.

NOTE ON THE GEOGRAPHICAL DISTRIBUTION OF CERTAIN MOLLUSKS.—The occasion for this note arises from a brief review of Professor A. G. Wetherby's paper "On the Geographical Distribution of certain Fresh-water Mollusks of North America, and the probable causes of their variation," in this journal, March, 1882, page 231. The entire paragraph reads, "The Strepoma-

tidæ first appear in New York, and are almost confined to the district occupied by the Unionidæ just mentioned. They do not cross the Mississippi, and are chiefly found in mountain streams." Now, this last statement, "they do not cross the Mississippi," does injustice to what Professor Wetherby really states in the paper reviewed, and does violence to the facts in the case. The statement made by the author reviewed is "This fauna [Fauna C] has a very limited distribution of genera and species west of the Mississippi * * ." (See Am. Jour. of Sciences, March, 1882, page 207.) Mr. Tryon, in his generally excellent monograph of the Strepomatidæ published as No. 253 of the Smithsonian Miscellaneous Collections (1873), made the same statement the writer in the NATURALIST made, but with reference solely to the Trypanostomoid division of that family; he recognizes the occurrence of *Goniobasis* in various streams west of the Mississippi and tributary to it, and also the few forms of doubtful generic relationship from California and Oregon (*Op. Cit.*, pp. xxxviii, xl, xli, xlvii, and xlviii). Of the genus *Goniobasis* there are seven forms from west of the Mississippi exclusive of those found on the Pacific slope. They are *Gon. cubicoides Gon. potosiensis*, *Gon. sordida*, *Gon. lirescens*, *Gon. ovoidea*, *Gon. haleiana*, and *Gon. alexandrensis*. I am not aware that *Gon. cubicoides* Anth. has been hitherto reported from any other habitat than Indiana; but the specimens to which reference is here made can be referred only to that species, with any degree of certainty. I obtained them from the Middle Raccoon river, Dallas county, Iowa, and have distributed them among some of my correspondents with labels as above. Of *Trypanostoma*, one species at least occurs west of the Mississippi—the *Try. subulara* Lea—which I desire to place on record here. Several hundred specimens were taken from the Des Moines river, at Fort Dodge, Webster county, Iowa, by the writer, many of which have likewise been distributed. They occur further to the westward, since five species of this family are accredited to Nebraska by Professor Aughey (Sketches of the Physical Geography and Geology of Nebraska, page 144), but specific names are not given; these latter, however, may be found in Bulletin U. S. Geological Survey, Vol. III, No. 3, to which I have not access at this writing. The streams of the western slope of the great basin of the Mississippi have not yet been examined with sufficient care to justify any statement as to their wealth in *Strepomatidæ*, but such evidence as is now accessible points to the conclusions reached by Professor Wetherby.

In the paper by Professor Wetherby (Am. Jour of Science, March, 1882, p. 208), occurs a most singular error in a matter of fact, which would seem to have an important bearing on the particular theme in connection with which the statement is made. Referring to the somewhat anomalous distribution of *Margaritana margaritifera* Linnè, he states that the species is found "in Maine

and Oregon, but not between these stations so far as now known." This statement gives that remarkable species too narrow a limit *by many thousands of square miles.* In 1843 appeared Vol. v of Part I (Zoölogy of New York), by James E. DeKay, in which, p. 197 (Plate XIV, Fig. 214), is given a description of this shell with the name *Alasmodon arcuata;* De Kay quotes it as "one of the largest and most commonest of our Unios," and states his specimens were from Rockland county, Champlain, Oneida and many other localities. Dr. Lewis (Bull. Buf. Soc. Nat. Sci., August, 1874, page 141) lists it among the shells of New York, as "reported orally, localities not known." I have five examples from a brook at Haydensville, Mass., and over 100 from a branch of the Connecticut river, near Hartland, Vermont, where it abounds. Beyond Maine the species is reported from various points in New Brunswick, and even from Newfoundland. Of its distribution in the western portions of America the following facts are known: "It is the most abundant of the fresh-water bivalves, and the only one I have been able to find in the Chehalis, the streams emptying into Puget sound, and most branches of the Columbia" (Cooper, Pacific R. R. Reports, Vol. XII, Pt. II, page 311).. It is also quoted from the Shasta river, Oregon, having been collected in that stream by Dr. Trask, and from the Klamath and Yuba. It is known to the eastward among the Rocky mountains, specimens having been taken from the Missouri river above the Falls; also from the Spokan river, below Lake Cœur d'Alene (Carpenter, Mollusks of west coast of North America, page 116). Concerning the conclusions drawn from this species, I am not prepared at this time to say anything. But to fix as a fact the important deduction that this form and the others mentioned in connection therewith are "remnants" of another fauna which has suffered such remarkable changes as incidental to glaciation is a matter which will yet require a vast amount of labor and research. The exact distribution of this species, since so much is made to depend on it, should be determined. It is believed that in this note all the known points of its occurrence in America have been, for the first time, brought together.—*R. Ellsworth Call.*

THE EUROPEAN HOUSE SPARROW.—*Passer domesticus* has its place in nature, possibly monarchical Europe, and monarchical individuals in other places can overestimate their worth, but in America they are out of place, and their introduction was a grievous mistake. Its disposition is very far from being republican, and its treatment of some of our native birds, which are of much more value than themselves, is tyrannical and despotic. Quarrelsome with and pugnacious towards the swallows, martins, wrens and bluebirds they take by force the houses put up especially for their use. Thanks for the love of liberty, right and justice, the swallow, martin, wren or bluebird having possession of the house can, and usually does succeed in keeping it against

the attack of a single pair of sparrows, but often, this pair, unsuccessful in their house-breaking attempt, go off and solicit the aid of their fellows, and return with a dozen or twenty of their kind, lay siege to the place, and by united effort *take it*, after the rightful occupants have made a desperate defence against enormous odds.

It may be only a coincidence—it is a fact, however, that as the sparrows have increased in numbers, the purple martins, *Progne purpurea*, have decreased in this locality.

The sparrows are essentially gramnivorous and frugivorous, and are not insectivorous in the legitimate use of the term. They are very destructive to garden and flower seeds, the small grains, and no species of fruit is free from their depredations. They are more dirty around the house than any of our native, social birds, dropping *en masse* their excrements about the door. I presume they have their good qualities. I cannot agree with Mr. Minot when he says of the purple grackles that he "would not hesitate to sign the death warrant of the whole race," but I would not hesitate to sign a warrant to banish the house sparrow from the United States to the place from which they came, and furnish a liberal supply of good food and clean water for the voyage.—*Elisha Slade, Somerset, Mass.*

The Opossum at Elmira, N. Y.—Some five years since Mr. H. C. Hill, of Norristown, Pa., where opossums are plenty, sent a female with eleven young, to Dr. Wilder at Ithaca.

Not altogether liking the Doctor's methods, and perhaps having doubts as to his intentions, they all made their escape and disappeared.

This may perhaps account for the one captured near Elmira, mentioned in the Naturalist.—*Franklin C. Hill.*

A Large Octopus on the Florida Coast.—I have in my possession an Octopus, caught in the Halifax river one mile inland from the sea, which weighed when caught two and a half pounds, measured from tip to tip of extended arms diagonally across the head twenty eight inches, longest arm sixteen inches with one hundred and ninety-eight suckers, shortest arm eight inches with eighty-seven suckers, other arms ten, thirteen, thirteen and a half and fifteen inches in length; one arm was broken in its capture. —*Mrs. N. Hasty, New Smyrna, Florida.*

Japanese Aquatic Animals Living on Land.—Among the conditions favorable to the transition from aquatic to terrestrial life, says Professor C. O. Whitman in his "Zoölogy in the University of Tokio," is a saturated atmosphere. This condition is found in Japan, and it is here that we find some very interesting cases of true aquatic animals living on land. Every one knows that the medicinal leech is a fresh-water animal. This leech has the habit of crawling partly or wholly out of water, when the air is so saturated with moisture that it can do so without exposing

its skin to dessication. The question naturally arises, could such a creature ever become habituated to living on land? When we remember that the skin of the leech performs the function of lungs, and that, provided it is kept wet, it is capable of drawing its supply of oxygen from moist air, there is no difficulty in understanding how such a change might be induced. Experiment has already shown that some water-breathing animals can without difficulty become air-breathers. The Mexican axolotl is a well known instance, and the Lymnæidæ which belong to the deep water fauna of the Lake of Geneva form another. Nature herself supplies us with numerous examples in which such a change is a normal occurrence in the animal's cycle of life. No one has undertaken to test the matter in the case of the leech; but there is every reason to believe that nature has made this experiment, and that the land-leech found on the mountains of this island, and in some other parts of the world, is a living demonstration of her success. In this country the land-leech is found near the tops of mountains, in dense thickets, where the ground is carpeted with moss and other low plants. During the dryest months of summer, these localities are kept moist by mists and showers. The structure of the leech has been modified to some extent in accommodation to its present mode of life, but this modification is in every particular one of adaptation. Not an organ has been lost or acquired, certain organs have been compelled to do more work in the land-leech than they do in the common leech, and the natural result has been multiplication and enlargement. The skin-glands have become larger and more numerous, and the urinary vesicles have expanded into bladder-like reservoirs. The liquid secretions of these organs supply any deficiency of water in the air, enabling the leech to keep its dermal respiratory organ constantly moist.

The land planarian forms also are interesting examples of the kind here considered. This worm, which creeps about in damp weather, somewhat like a slug, is abundant in this island, and in many of the islands to the south. It has a wider distribution than the land-leech, being found in nearly all temperate and tropical zones, not only on islands, but also on the continents, where the moisture of island atmosphere prevails.

There is another very remarkable case, allied in some respects to those just mentioned. What could seem more out of place than a fish on land! It would seem that fishes are especially adapted to live exclusively in water. In providing the fish with fins, and with a respiratory organ in the form of gills, nature seems to have decreed that one class of animals should have a place and keep it. But all her devices to keep certain members of the finny tribe within the prescribed medium have failed. Among those remarkable fishes which have succeeded in overcoming every obstacle to living out of water, at least one very interesting species occurs on the coasts of Japan. This is the

jumping-fish (*Periophthalmus modestus* Siebold), or the "Tobi-haze" as the Japanese call it. This fish is more truly amphibious than the frog, for it is able to change the mode of its respiration at pleasure, breathing water and air alternately. It is accustomed to spend a great part of the time out of water, and actually appears to prefer the air to water. If one attempts to capture it, it rarely, if ever, plunges into the water, but skips along the surface. It can climb up the steep sides of rocks or plants, and jumps along the shore in quest of insects and other small animals, with the agility of a frog. When out of water, it puffs up the cheeks with air, which is held for a short time and then renewed.

Zones of Life in the Ocean.—Mr. A. Agassiz, in the third volume of the report of the scientific results of the voyage of the *Challenger*, recognizes three belts or zones of life from shore to the greatest ocean depths. The following extract is taken from the Harvard University Bulletin No. 21. "The discovery by Count Pourtales, in his first dredgings off the Florida reefs, of ancient forms closely resembling types and genera characteristic of the chalk, first suggested the probability of the theories which looked upon the oceanic basins as of very ancient origin, and of their having retained practically unchanged the limits they now occupy from the time of the later Jurassic period. This ancient facies of many of the deep-sea Echini has also been traced in other groups of the animal kingdom. Professor Alph. Milne Edwards, in some of his preliminary reports on the Crustacea of the *Blake* calls special attention to the resemblance of some of the deep-sea types to the Jurassic and Cretaceous forms.

"In making a comparison of the bathymetrical belts, Mr. Agassiz has found it convenient to recognize three such belts which are mainly dependent for their characteristics on their temperature; pressure, representing great depth, apparently being a very unimportant element in the distribution of the species.

"The first belt, the littoral, extending from low-water mark to a depth of about 100–150 fms., represents what is usually known as the continental line (the 100 fm. line). It is the plateau which is found to represent the extension of the coast line to a depth at which the influence of the direct action of the sun's heat is limited. The next or "continental belt," extends from this continental line to a depth of 450–500 fms., and represents the steep slope which has been subject to greater or less disturbance during the formation of the shore deposits and of the continental plateaus while they were assuming little by little their present outlines; it represents also the bathymetrical belt, in which the diminution of temperature is very rapid, the third belt, the abyssal region, extends from the continental limit to the greatest depths which have thus far been obtained. This region embraces the great oceanic floors where life is somewhat less abundant than along the continental belt, where the detritus carried to its slope supplies abundant food to

the animals living within its limits. It is also a region in which the temperature is very low, where it varies but little from the freezing point, and where the conditions under which the animals now living there have probably remained undisturbed for a considerable period of time, geologically speaking. It is in this abyssal region that we find the greatest number of forms having an ancient facies. In the continental belt they are less numerous, and their resemblance is more with the types of the later geological periods."

STELLER'S MANATEE.—In his "Voyage of the *Vega*," Baron Nordenskjöld has collected all information attainable on Steller's sea-cow *(Rhytina Stelleri)*, which on Steller's visit to Bering island in 1741, was found pasturing in large herds on the abundant sea-weeds on the shores of the island. Twenty-seven years after, not a specimen was to be found, and it was believed to be then extinct. But Baron Nordenskjöld adduces evidence to prove that a specimen was seen twenty-seven years ago, though there can be little doubt that it has really gone the way of the mammoth. The Baron does not believe that its extinction is due to the destruction by hunters, but that it was a survival from a past age doomed to extinction, which overtook it when driven from its pastures on the shores of Bering island.

Steller's sea-cow *(Rhytina Stelleri* Cuvier) in a way took the place of the cloven-footed animals among the marine mammalia. The sea-cow was of a dark-brown color, sometime varied with white spots or streaks. The thick leathery skin was covered with hair which grew together so as to form an exterior skin, which was full of vermin and resembled the bark of an old oak. The full-grown animal was from twenty-five to thirty-eight English feet in length and weighed about sixty-seven cwt. The head was small in proportion to the large thick body, the neck short, the body diminishing rapidly behind. The short foreleg terminated abruptly without fingers or nails, but was overgrown with a number of short thickly placed brush-hairs; the hind-leg was replaced by a tail-fin resembling a whale's. The animals wanted teeth, but was instead provided with two masticating plates, one in the gum, the other in the under jaw. The udders of the female, which abounded in milk, were placed between the fore-limbs. The flesh and milk resembled those of horned cattle, indeed in Steller's opinion surpassed them. The sea-cows were almost constantly employed in pasturing on the sea-weed which grew luxuriantly on the coast, moving the head and neck while so doing much in the same way as an ox. While they pastured they showed great voracity, and did not allow themselves to be disturbed in the least by the presence of man. One might even touch them without their being frightened or disturbed. They entertained great attachment to each other, and when one was harpooned the others made incredible attempts to rescue it.

ZOOLOGICAL NOTES.—Professor Felix Plateau gives directions for the rapid preparation of large myological preparations, of which we copy his abstract: 1. Maceration in alum during dissection; 2. Wash with pure water; 3. Tint with carmine; 4. Fix the carmine with alum; 5. Maceration in phenicized glycerine; 6. Suppression of the excess of glycerine by compression between absorbent paper. The article is published in full in the Proceedings of the French Association for the Advancement of Science, 1880.——Professor B. G. Wilder has published in the Proceedings of the American Philosophical Society the anatomy of the brain of the cat, accompanied by numerous figures.——Professor Owen lately read a paper before the Linnean Society on the homology of the conario-hypophysial tract, or the so-called pineal and pituitary glands. He propounds the view that it is the modified homologue of the mouth and gullet of invertebrates; that the subœsophageal ganglia and succeeding nervous cord constitute the centers whence are derived and caudally continued the homologues of the vertebrate myelon.——Mr. W. A. Forbes exhibited at a late meeting of the London Zoölogical Society horns of the prong-horned antelope *(Antilocapra americana)* lately shed by the specimen living in the society's garden. This was, it is believed, the first instance on record of the same individual having shed its horns in captivity in two consecutive years. He also read a paper on the existence of a gall bladder in barbets and toucans. From the peculiar form of the gall bladder in these birds, as well as other features of their myology which he describes, the relationship of these birds to the woodpeckers becomes still more evident than previously stated by Nitzsch, Kessler, Garrod and others.——The last number of the *Memoirs* of the Boston Society of Natural History contains descriptions, with excellent figures on three plates, of new Hydroids from Chesapeake bay, by Professor S. F. Clarke. A new genus *(Calyptospadix cerulea*, n. sp.), is described. The most interesting of the six forms is *Stylactis arge*, "which has the remarkable habit of dividing its hydranths by a transverse partition, leaving the distal half free, which latter, with its two or three hydrorhizal processes that are developed before the division takes place, floats away free, being carried about by currents; finally it settles down, becomes attached, and by growth and budding gives rise to a new colony. It is another method in which the Hydroids are already so rich, by virtue of which they increase their numbers and their geographical distribution."—— The Peabody Academy of Sciences has resumed the issue of its *Memoirs*. Vol. 1, No. 5, is devoted to Contributions to the Anatomy of Holothurians, by Mr. J. S. Kingsley; and No. 6 to Mr. J. W. Fewkes' development of the pluteus of Arbacia, which differs in certain details from that of Echinocidaris as worked out by J. Müller.——At a recent meeting of the Linnean Society of London, Professor Cobbold exhib-

ited a large Guinea worm taken from a pony, in Madras. Only one previous instance of the occurrence of this parasite in the horse has been mentioned, and its authenticity has been doubted. ——Kossman in *Zoologischer Anzeiger* states that the Entoniscus, a parasite Isopod, is an endoparasite; these Isopods are usually external parasites.——C. P. Sluiter in the same journal describes the segmental organs in certain Sipunculidæ from Malaysia.——Farther additions to our knowledge of the fishes of Lower California and the Gulf of California are recorded in the Proceedings of the U. S. National Museum by Messrs. Jordan and Gilbert.—— Another paper of value in the same serial is that of Mr. Dall on the genera of Chitons, especially the fossil forms.——An elaborate account of the structure and development of the gar pike by Messrs. Balfour and Parker, read before the Royal Society, is reported in *Nature*. As regards the skull the authors say that its morphology cannot be understood "unless it be seen in the light derived from that of the Elasmobranchs, the sturgeon, and the anurous larva on one hand, and that of *Amia calva* and the Teleostei on the other.——P. Geddes gives in *Nature* an abstract of an important paper on animals containing chlorophyll, such as Spongilla, Hydra, and certain Planarians, while others as Actinia, &c., contain chlorophyll originating from minute algæ which he calls *Philozoön*, which inhabit these animals. The same discovery was recently published by Dr. Brandt, so that both observers independently arrive at nearly the same conclusions, M. Geddes, however, differing in some important particulars.

ENTOMOLOGY.[1]

Carnivorous Habits of Microcentrus retinervis.—I noted a circumstance on Sunday, October 23, which to me was very interesting. On what is called Mill island, in the Mississippi, two miles above Burlington, there are a number of burr oaks clustered on the extreme point of the island. The trunks were covered with thousands of *Megilla maculata* Deg. A large number of Locustidæ, I think *Microcentrus retinervis* (as near as I can determine them), were apparently feeding upon the beetles. It was so much aside from the habits of the Locustidæ, as I thought them to be strictly herbivorous, that I watched them very closely. They seized the beetles with their front legs, holding them in the same manner as a squirrel its food, and kept biting until the wing covers were broken through, then masticated the abdomen. I took a number of fragments of the beetles as they were cast off, so I could not be deceived.—*H. G. Griffith, Burlington, Iowa.*

Note on the First Insect from Wrangell Island.—Dr. I. C. Rosse, of the *Corwin*, has given me a small spider and a dried

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

larva, which he picked up during a short visit of the *Corwin* to Wrangell island. As the officers of the *Corwin* were the first persons ever known to have landed upon this island, it is probable that these are the first insects from that locality, and it may therefore be interesting to note that the spider has been identified by Mr. Geo. Marx, of the Department of Agriculture, as "an undescribed species of *Erigone*," the larva being probably lepidopterous, but in too poor condition for determination.—*J. H. Kidder, Washington, February 6th, 1882.*

Lichtenstein's Theory as to Dimorphic, asexual Females.—The translation into French by our friend, M. Jules Lichtenstein, of Dr. Adler's renowned paper on Dimorphism in Cynipidæ will be very welcome to all those who do not understand the German language, especially as the original and admirable plates are reproduced. We have already noticed Adler's discoveries. In the preface to the translation which Lichtenstein gives, is a very amusing illustration of the insufficient and misleading nature of his theory regarding the evolution of the Aphididæ, where he insists on calling the winged females *larvæ*, and their eggs *pupæ*, since he carries the analogy into the Cynipidæ, and would call the asexual females larvæ. He draws what he conceives to be proof of the correctness of his theory from the hypermetamorphoses of the Meloidæ, designating the coarctate larva as a pupa and implying that it shows the eyes, legs and jaws of the perfect insect, and yet produces instead of a perfect insect a larva like that from which it was formed. The error in this comparison lies in calling the fourth larval stage the pupa, when it has nothing to do with the pupa, but is simply a quiescent larva indicating none of the members of the perfect insect. It is in fact, as we have called it, a *coarctate larva*, and the eyes, legs and jaws represent those of the larva and have simply become rigid, whereas those of the perfect insect, as subsequently foreshadowed in the true pupa, have a quiet different aspect, and we fail to see how this coarctate larva form can be compared with an asexual female Cynips any more than with a female of the bisexual generation. The translator's work is admirably done and he adds an instructive catalogue of the known species of Cynipidæ at the end.—*C. V. Riley.*

Naphthaline Cones for the protection of Insect Collections.—Mr. C. A. Blake, of Philadelphia, has been preparing cones of naphthaline run around a pin so that they may be stuck into a box with insects and that the naphthaline may permeate the box and last for a considerable time. They are made after a formula recommended by Drs. LeConte and Horn, and are very convenient to handle. They gave such promise of usefulness that we obtained quite a lot of them and went to the trouble of supplying all our insect boxes with the same. We have speedily

rejected them, however, and give this note of warning, especially to lepidopterists to whom they will prove particularly objectionable, as our experience of a few weeks suffices to show that they very quickly encourage greasing, and soon produce a relaxed sordid or greasy appearance of the insects. Another objection is, that by deliquescence the pale chocolate color of the cones communicates to, and discolors the lining of the boxes wherever it comes in contact therewith. They may not be so objectionable for Coleoptera and Hemiptera, though in many families they would certainly prove injurious. We much prefer the old method of protection, viz: the pouring in the box of a little pure benzine, or what is better, according to LeConte's formula, a mixture of 1 oz. nitro-benzole, 1 pint alcohol, ½ oz. carbolic acid and 1 pint pure benzole.

Injurious Insects in California.—Our California friends are very active in their warfare with the increasing number of their insect pests, and Mr. Matthew Cooke, chief executive horticultural and health officer, has recently sent us a neatly bound little treatise on the insects injurious to fruits and fruit trees of California, giving a good deal of valuable practical information which must be productive of great good. Mr. Cooke lays no special claim to entomological knowledge, and several determinations are erroneous. It is doubtful, *e. g.*, whether *Clisiocampa americana* or *Orgyia leucostigma* occur on the Pacific coast, and other species of these genera must be intended; while the determination, as *Nematus similaris*, of a saw-fly larva injuring pear trees is made without any warrant, so far as we can find, the insect which we have bred from cocoons sent us by Mr. Cooke, proving to be something quite different. These technical shortcomings do not, however, impair the practical value of the manual.

Sarcophaga lineata destructive to Locusts in the Dardanelles.—From communications by Mr. Frank Calvert to members of the London Entomological Society, and a report of a committee appointed by said society to inquire into the matter, it appears that *Œdipoda cruciata* Charp., which is the destructive species there, is preyed upon by parasites closely related to those which attack our *Caloptenus spretus*, and very much in the same way. Two Dipterous species are worthy of note, viz., a flesh-fly, (*Sarcophaga lineata* Fall.) and a bee-fly (*Callostoma fascipennis* Macq.). Of the *Sarcophaga*, Mr. Calvert remarks:

"I beg leave to call your particular attention to the larva that is found in the body of the locust, no longer a matter of doubt. Each locust has from one to three of these larvæ, which are seen on tearing open the neck and thorax. When the locust dies the larva, which is very active, leaves the body and buries itself in the ground with haste—proved by experiments I have made. The head is provided with a couple of black hooks which can be drawn in; these hooks are used when the larva is in motion, and to bury itself.

After a few hours the larva loses its liveliness in the ground. I have no pods at present to try if the larva feeds on the eggs of the locust.

A remarkable coincidence with the appearance of the parasite is the melting away of the immense swarms of locusts that were hatched; it is true some were devoured, but the great masses have died before the deposit of the egg; the country so freed round us is about twenty miles by forty. It is difficult to find locusts for specimens! * * * The body parasite has destroyed the locusts that escaped the Callostoma over 800 square miles.

PARASITIC DIPTERA.—To the parasitic Diptera that are already well known, Dilophus, a genus of Bibionidæ, should, it appears now be added as, according to Mr. R. H. Meade of England, it has recently been bred from larvæ of *Chætoptria hypericana*. The Bibionidæ have hitherto been known only as vegetable feeders in the larva state.

DORSAL LOCOMOTION OF ALLORHINA NITIDA.—In the October, 1879, number of the *Canadian Entomologist*, I published a note on the larvæ of *Lachnosterna fusca*, remarking on the numbers in which they occurred in the lawn in front of the Capitol at Washington, and describing the peculiar manner in which the larvæ moved when placed upon a smooth surface—immediately turning upon their backs and moving forward with considerable rapidity by the alternate contraction and expansion of the segments. The specimens were determined for me as Lachnosterna by an experienced coleopterist; but the next year, by the rearing of the adult, they were proved to have been *Allorhina nitida*. Professor Riley had meanwhile called my attention to the fact that in Le Baron's fourth report, he had figured the larvæ of the latter species upon its back and in the act of progression. The statement is also made in this report that this larva "when out of the ground crawls with ease on its back."

This interesting habit is not confined to this species, as Rev. Samuel Lockwood, in the AMERICAN NATURALIST, 1868, mentions the same fact of the full-grown larva of *Catalpa lanigera*, stating, however, that the young larvæ walked normally upon their legs. Other Scarabæid larvæ will doubtless be found to share in the same habit.—*L. O. Howard.*[1]

MODES BY WHICH SCALE-INSECTS SPREAD FROM TREE TO TREE.—I watched to-day a colony of *Hyperaspidius coccidivorus* Ashmead which has for two months or more been increasing on the trunk of a tall seedling orange tree. The main trunk of the tree is covered densely with Chaff scale,[2] and upon it the larvæ and imagos of the beetle are feeding. The greater number are now in imago. I found but one pupa although larvæ are still abundant. The

[1] Mr. W. Kite of Germantown, Philadelphia, sent to NATURALIST, some months ago, a description of the same habit.

[2] *Parlatoria Pergandii* Comstock.—ED.

beetles, both larva and imago, feed upon the Coccids in all their stages. They never bite through or tear off the scale, but seem to push their heads under, between the bark and the scale. Larvæ of the scale-insect are quite abundant on the trunk, and these are sucked by the Coccinellid. Although this is not properly a breeding time of the scale, there are considerable numbers of scale larvæ wandering about, and I noticed again and again that they frequently mount upon the bodies of the Coccinellids while the latter are feeding and without attracting the attention of the beetle. It even seems to me that they are attracted by the smooth and shining surface of the Hyperaspidius' elytra, as I sometimes saw three or four of the scale larvæ together upon the back of a single individual of this extremely small beetle. As several large Coccinellids, *Chilocorus bivulnerus, et al.*, are extremely common in all our groves, and all feed more or less upon Coccids, it does not seem surprising that the scale should spread from tree to tree. Another method of transportation has recently occurred to me. The shrike or butcher bird is very fond of selecting orange thorns as places to store insects. The bird is extremely common, and of course preferably selects orange trees that have long straggling branches, in fact, precisely those that are most thickly infested with Long scale. I know of one grove, much infested with scale and where at any time may be collected a double handful of dead or living insects (Orthoptera and common beetles like Phanæus) from the orange thorns upon which they have been impaled. The thorns on infected branches are always thickly coated with long scale, and in impaling a hard shelled insect like Phanæus many scales are torn off, and both scales and their eggs adhere to the insect. The shrike sometimes transfers the insects it has impaled upon one tree to a thorn upon another tree, or after making a meal of its prey which it takes off of a thorn, the bird flies off and wipes its bill on the next tree. In this way as well as upon its feet, the bird must spread scales from tree to tree.—*H. G. Hubbard, Crescent City, Fla., Dec. 12, 1881.*

ANTHROPOLOGY.[1]

CHARNEY ON THE AGE OF PALANQUE.—I am strongly inclined to agree in the main, though not entirely with Charney's opinion in reference to the age of Palanque as expressed in the October number, 1881, of the *North American Review*. But the inscription on the tablet presents a serious difficulty to his supposition that it was of Toltec origin, unless Toltec and Maya be the same.

This is undoubtedly Maya, as it is not difficult to show that at least fifty of the characters are the symbols or hieroglyphs of Maya days and months with accompanying numerals. The large initial at the upper left-hand corner is probably the hieroglyph of the word *Pacumchac*, the name of a great religious festival held in

[1] Edited by Professor OTIS T. MASON, 1305 Q. street, N. W., Washington, D. C.

the month *Pax*, which accounts for the repeated introduction of the character for this month in the inscription.

The four characters by the side of the upright of the cross are the symbols of four days, each with the numeral *five* attached, and correspond to the day columns of the Manuscript Troano.

The whole inscription is doubtless a religious calendar relating chiefly to the festival mentioned. I call attention here to the fact that a reduced and imperfect copy of this cross is found on the back of one of the Copan statues; see middle plate between pages 156 and 157, Stephen's Travels in Central America, Harper's edition, 1877.—*C. Thomas.*

MAJOR POWELL'S FIRST ANNUAL REPORT.—Within a few days a handsome volume has been placed in our hands, entitled, First annual report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, 1879–'80, by J. W. Powell, Director. Washington, Government Printing Office, 1881, XXXVI, 603 pp., gr. in 8vo, with 1 map, 346 figures.

The report of Major Powell, which occupies 86 pages consists of an account of the work done and in progress by the Bureau of Ethnology, and the following papers by Major Powell:

On the Evolution of Language, pp. 3–8.
The Mythology of the North American Indians, with several new myths, pp. 19–52.
The Wyandot Government, pp. 59–68.
On limitations to the use of some anthropologic data, pp. 73–86.

The succeeding pages of the volume are occupied with the following monographs:

A further contribution to the study of the Mortuary Customs of the North American Indians, by H. C. Yarrow, pp. 89–203, figures 1–47.

Studies in Central American Picture Writing, by E. S. Holden, pp. 205–545, figures 48–60.

Cession of land by Indian tribes to the United States, by C. C. Royce, pp. 247–262.

Sign language among North American Indians compared with that among other peoples and deaf-mutes, by Garrick Mallery, pp, 263–552, figures 61–346.

Catalogue of linguistic manuscripts in the library of the Bureau of Ethnology, by J. C. Pilling, pp. 555–562.

Illustrations of the method of recording Indian languages. From the manuscripts of Messrs. J. O. Dorsey, A. S. Gatschet and S. R. Riggs.

No more important contribution to the science of anthropology has ever been made than the volume before us. Every contributor, Powell, Yarrow, Royce, Mallery, Pilling, Dorsey, Gatschet and Riggs, excepting Professor Holden, is *facile princeps* in the subject of which he treats, and no one who is at all familiar with the vague methods in vogue respecting the decipherment of Central American hieroglyphics, will withhold from the astronomer the credit which he deserves for applying rigid scientific methods in a new horizon.

In its form and preparation, the volume is faultless. It is royal octavo in size, printed upon cream calendered paper. The illustrations have no parallel in modern anthropological works, except

perhaps in the English editions of Evans' Stone Implements, indeed we do not know which to admire the more, the gorgeous lithographs in Dr. Yarrow's paper or the life-like wood-cuts in that of Colonel Mallery.

The works of Major Powell, Dr. Yarrow and Colonel Mallery are so well known that, did our space allow, there would be no need of an extended review. It is sufficient to say that each author has embodied in his sketch his best and latest thoughts. The articles by Professor Holden and Mr. Royce are not so well known, each author having traversed an untrodden field, or at least having followed unbeaten tracks.

Professor Holden attempts to apply the methods employed in the interpretation of the ordinary cipher writing to the deciphering of the inscriptions of Yucatan. The slabs in Stephen's and other works are indicated by Roman numerals and letters, and each hieroglyph has a number. A copy of the plates was then cut up and each glyph pasted on a separate card, which also bore the plate and glyph number, and the other numbers with which the glyph corresponded. Thus each form is known and the exact location where it appears. These cards may be arranged in any way the student sees fit, and indeed the case of 1500 cards has been deposited in the Bureau of Ethnology for the use of investigators. The rest of Professor Holden's paper is occupied with the comparison of Palenque and Copan with Mexican hieroglyphics and bas-reliefs.

Mr. Royce, formerly connected with the land division of the Indian office, years ago conceived the idea of illustrating, by means of colored maps and descriptive texts, the time and the manner in which the aborigines of the United States have surrendered their territory to the whites. Nothing in the way of ethnologic work now going on has interested us more. Indeed, one has no trouble to imagine, as the author proceeds, that he can see the savage title vanishing as breath from a pane of glass. The State of Indiana is given in the present volume, but Mr. Royce's work, when finished, will include the treaty cessions of the whole Union.

In closing it is only justice to Mr. Pilling, the editor, to say that much of the attractiveness of the volume is due to his good taste. The catalogue of manuscripts, pages 555–577, is a foretaste of what his great bibliography will be.

LUBBOCK'S ORIGIN OF CIVILIZATION. — Those who are now active in ethnologic work should never forget the debt of gratitude they owe to those masters at whose feet they learned the rudiments of their science. The Appletons, foremost of American publishers to foster science, have just issued the fourth edition of Sir John Lubbock's Origin of Civilization, which was, at its first appearance, an epoch-making work. The opinions set forth by Archbishop Whately and others, that all savages are the

degenerate descendants of far superior ancestors, that no community ever did or ever can emerge from utter barbarism to civilization was first successfully met by Sir John Lubbock, who was able, from a wide generalization, to demonstrate the contrary. Arts, ornaments, marriage, relationship, religion, ethics, language and law are each treated as organisms, and followed up from very humble beginnings to their very highest development. The reader is not called upon to follow the author through the dim mazes of speculation, but each argument is enforced by a concrete example taken now from one part of the world, now from another. Mr. Lubbock is a most charming writer, never losing his sense of courtesy to his opponents, and moving on by a settled plan to his conclusion.

PRE-INDIAN ABORIGINES.—From the Boston *Evening Transcript* of Feb. 4th, we clip the report of a paper by Professor Henry W. Haynes upon the existence in New England, in very early times, of a race of men different from and far less advanced than the Indians. The evidence is the occurrence of rude, coarse, stone implements in numerous localities where none of the ordinary evidences of Indian occupation could be found. Professor Putnam exhibited at the same meeting a collection of rude surface implements from Marshfield, in order to emphasize the fact that conclusions relating to the antiquity of relics could not be drawn simply from the character of the specimens themselves.

Will not all our kind friends whose papers or discussions are reported in the daily press send a copy to the editor of this department?

WERE COPPER AXES SWEDGED OR CAST?—The Kansas City *Review* of February has an article by Professor H. A. Reid on the above subject, in which he gracefully makes his adieu to a former opinion, and frankly shakes the hand of Dr. Hoy on the swedge theory. It takes a brave man to say, "I was wrong."

ANTHROPOLOGY IN FRANCE.—The *Revue d'Anthropologie* is the most prompt and readable of all our anthropological journals; Vol. v, No. 1, for January, 1882, comes in good time and is not behind in value. Three original papers are given, two by the editor.

Le poids du cerveau, d'après les registres de Paul Broca, by Paul Topinard.

De l'Acclimatement dans le race noire africaine, by Dr. A. Corre. [Especially valuable to American students.]

De l'Indice cephalique sur le crane et sur le vivant, d'après Broca, by Paul Topinard.

The rest of the number is filled with reviews by specialists, among them the following American works are considered: Powell's Introduction, Yarrow's Mortuary Customs, Smithsonian Report, and the Fossil man of Brazil, by Quatrefages.

GEOLOGY AND PALÆONTOLOGY.

A SECOND GENUS OF EOCENE PLAGIAULACIDÆ. — Although many of the Mammalia of the Lower Eocene formation resemble the *Marsupialia*, characters which are unquestionably those of that order, have not yet been observed. They appear in many instances to possess characteristics of the insectivorous and carnivorous orders as well, so that it has been thought best to refer them to a single order in combination with the *Insectivora*, the *Bunotheria*. Some new species, however, present the marsupial facies so decidedly as to leave no alternative but to refer them to that order, until further evidence shall confirm or set aside such a conclusion.

The new genus now to be treated of is not very nearly related to any existing form of marsupials The nearest ally, *Plagiaulax*, is a genus of the Jurassic age, which has been referred by Professor Marsh to a distinct order, under the name of the *Allotheria*. As Professor Marsh does not offer any characters by which this group can be distinguished as an order from either the *Marsupialia* or the *Bunotheria*, I have not been able to adopt it. As Falconer has suggested, the nearest ally is perhaps *Hypsiprymnus* among the existing Marsupials, and *Thylacoleo* has, perhaps, an equal affinity. As the only part of the structure of these genera which is well known is the dentition, I define them as follows:

The family of the *Plagiaulacidæ* differs from that of the *Macropodidæ* in the possession of but two inferior true molars. Most of the genera have the fourth premolar trenchant, and generally those anterior to it also, while there is but one, if any—the third —in the *Macropidæ*. There may, however, be but one in *Catopsalis*. The genera differ as follows:

a. One large premolar, which presents anteriorly.

Fourth premolar with a cutting edge anteriorly, and a free posterior cusp; molars with numerous cusps ..... *Catopsalis.*

aa. Several large premolars which present upwards.

Premolars four, not ridged..... *Ctenacodon.*

Premolars with lateral ridges extending to the posterior edge of the crown..... *Plagiaulax.*

Premolars with lateral ridges not extending to the posterior edge of the crown ..... *Ptilodus.*

Of the above genera, *Plagiaulax* is represented by two species in the English Jurassic; *Ctenacodon* by two species in the North American Jurassic; *Ptilodus* probably by two species from the Lower Eocene, one from France according to Lemoine, and one from North America; and *Catopsalis* by one species from the Lower Eocene of North America, which I now describe.

Catopsalis foliatus, gen. et sp. nov.

Char. Specif.—The mandibular ramus which represents this animal, is robust and deep. The alveolar line rises from behind forwards, as in *Elephantidæ* and various rodents, and then sud-

denly descends. The inner side of the ramus is concave, while the external side, anterior to the masseteric fossa is convex. The incisive alveolus is thus thrown inside the line of the molars in front. There is a large fossa exposed by weathering, below and behind the last molar, which is identical with that seen in *Hypsiprymnus* and *Macropus*, and indicates a large dental foramen. Below the middle of the fourth premolar tooth, the incisor tooth is quite large, suggesting whether it had not a persistent growth, as in the rodentia.

The posterior cusp of the fourth premolar is triangular in profile, the anterior edge descending steeply. It is uncertain whether the edge of the crown rises again, forming another lobe. The apex of the cusp is conic. The first true molar is of large size and remarkable form. The crown viewed from above is a long oval. It has a deep median longitudinal groove, which sends out branch grooves alternately, and at right angles to the edge. The spaces between the grooves form block-shaped tubercles, four on the inner and five on the outer sides, whose transverse diameter generally exceeds their anteroposterior. The median groove is open at its anterior extremity; the posterior is closed by an elevated convex margin. The apices of the lobes are obtuse where not distinctly worn. The last (second) true molar is much shorter, and a little wider than the first, and has the same character of surface. There are two large tubercles on the inner side, and four smaller on the external side. The posterior end of the crown is narrower than the anterior. The anterior base of the coronoid process is opposite the posterior extremity of the first true molar tooth. The jaw with its dentition, in its present condition, has a curious resemblance to that of a tubercular-toothed *Mastodon*, with the order of size of the molars reversed. Length of base of fourth premolar .0108. Vertical diameter of root of incisor .0070. Diameters M. I; anteroposterior .0107, transverse .0050; diameters M. II; anteroposterior, .0060, transverse .0060; depth of ramus at front of P-m. IV, .0120; depth of ramus at front of M. I, .0190; depth of ramus at posterior edge of M. II, .0150.

Found by D. Baldwin in the Puerco bed of Northwestern New Mexico.—*E. D. Cope.*

Two New Genera of the Puerco Eocene.—*Haploconus lincatus*, gen. et sp. nov.—*Char. gen.* The same as *Anisonchus*, excepting that the crown of the third superior premolar is a simple cone, wanting the large crescentic crest of the inner side seen in that genus and *Catathlæus*. It is more nearly allied to the two genera named than to *Phenacodus*. *Char. specif.* These are derived from a number of specimens, the species having been abundant in New Mexico in the earliest epoch of the Tertiary. It is about the size of the *Anisonchus sectorius*, and differs from it in

several details besides in the generic characters. In the *H. lineatus* the base of the posterior inner tubercle of the superior molars is more distinct, and projects further inwards. The fourth premolar is relatively larger, and the enamel is delicately plicate, remotely approaching the condition of the surface seen in *Catathlæus rhabdodon.* In the inferior molars, the anterior marginal tubercle is wanting. The first premolar has but one root; the second and third have a posterior but no anterior basal lobe. The canines of both jaws are rather large, are acute, and flat on the inner side, and vertical in direction. Length of superior molar series M. .032; of premolars, .021; diameters P-m. IV; anteroposterior, .005; transverse, .006; of last true molar, anteroposterior, .004; transverse, .0065. Depth of ramus mandibuli at M. I, .0127.

A second species of this genus is probably the *H. angustus*, from the same horizon, which I described as a *Mioclænus.*

Pantolambda bathmodon, gen. et sp. nov. Founded on a mandibular ramus which supports the first true molar and the last two premolars. The characters of these teeth remarkably resemble those of *Coryphodon. Char. gen.* Crowns of molars supporting two Vs, of which the posterior wears lower than the anterior. Premolars III and IV, crowns consisting of one V and a short median longitudinal crest, as in *Coryphodon*; II and I, unknown. The character which indicates that the genus is distinct from *Coryphodon* is the elevation of the anterior branch of the anterior V of the true molar, which is more elevated than the posterior branch. In Coryphodon it is much less elevated. The type species is smaller than any known Coryphodontid. *Char. specif.* The bases of the P-m. III and IV are subquadrate, the inner side rounded, that of the IV relatively the wider. On the III the median keel constitutes the heel; on the IV, the keel is in the center of a wide heel. No cingula. The first true molar has an anterior cingulum, but no external one. The enamel is wrinkled where not worn. Diameters of P-m. III, anteroposterior, .009; transverse, .007; of P-m. IV; anteroposterior, .009; transverse, .0085. Width of first true molar in front, .0083. Apparently about the size of a sheep.

It will be for additional material to demonstrate whether this genus belongs to the *Amblypoda* or *Perissodactyla.* It was discovered with the preceding species by Mr. D. Baldwin in the Puerco formation of N. W. New Mexico.—*E. D. Cope.*

"Mud Lumps" and Mounds near New Orleans.—While attached to a Coast Survey party working on the Mississippi river, I was informed that there were three "Indian mounds" back in the edge of the swamp; on examination they proved to be "mud lumps," but of a shape and material different from those at the mouth of the river. I have looked over various works on geology, but can find no notice of any of these elevations so far

above the river mouth, and no very satisfactory explanation of the manner in which they are formed or of the forces forming them. The mounds above spoken of are on the left bank of the river, on the place of Mr. Louis Le Bourgeois, fifty-five miles above New Orleans, they are about one and a-half miles back from the river and just in the edge of the swamp. The largest one is 40 feet in height and 144 feet in diameter, conical in shape with no signs of a crater. 300 yards N. × E. from it is a smaller one, 15 feet in height and 80 feet in diameter. 250 yards E. N. E. is another, not more than 5 feet in height and 20 feet in diameter. Formerly the large mound was entirely surrounded by a circle of these small elevations, but they have been leveled during the process of cultivation. The surface soil around the mounds is the usual black alluvium of the valley.

Mr. Ogden, U. S. Navy, and myself cut into the large mound from the top to a depth of 18.5 feet, and found as follows: There were less than two inches of vegetable mold, and the remainder of the excavation was cut through a hard orange sand; it was so hard that the pick had to be used continuously; single valves of shells, apparently Corbula, were abundant as far down as we went; to a depth of ten feet the shells were mostly soft and calcareous, below that they were all silicified; limestone concretions were very abundant, though generally small; six feet below the surface there was a layer or bed of these shells, with the valves separate; this bed was three feet wide and long, and about three inches thick, and immediately underneath it the sand was black; in some case rough concretions were attached to the shells. There were numerous black spots about the size of buck-shot thickly scattered throughout the whole extent of the excavation; under the microscope these black spots proved to be aggregations of sand; we considered them probably the result of the destruction of minute shells. Eight feet below the surface there was a handful of blue clay and sand mixed, and a little below that a handful of fine gray sand. Half way down the side of the mound I found the same material and appearances, and at the beginning of the slope, the orange sand lay thirty inches from the surface; thirteen feet out from the bottom of the mound, it was necessary to cut through forty-seven inches of alluvium to reach the orange sand, and nineteen feet out it could not be found at all.

About 100 yards from the mound there was a deep ditch, in the bottom of which there was indication, in one place, of the orange sand, eight feet below the surface, but I think that it had been brought from a greater depth by crayfish. The large mound is thickly covered with a growth of magnolia, ironwood, cane and a species of wild climbing vine. During the summer season, as we were informed, flowers peculiar to the mound are found. From the regular shape of the large mound, broken only by holes dug by treasure-hunting negroes, it seems probable

that the mound-builders may have shaped it to suit their ideas of symmetry. On the right bank of the river, some three miles back, and in the swamp, I was told by the negroes there were two other large mounds similar in appearance to the one described above. I did not have time to see and examine them. Below New Orleans I noticed two small irregular lumps, bearing evidence of a crater on one side, in one, and in the center in the other.

At Southwest Pass there is a mound, or elevated area, called a "salt mound," from the well of salt water in the center. The pilots told me that when these lumps, or areas, are thrown up, there are, at first, salt wells on them; the wells are very deep and boil up, apparently from escaping gas; ultimately the wells fill up and disappear. There are frequent vibrations, and horizontal and vertical movements of the land in the passes. On one of the lumps in Southwest Pass there is a well discharging an inflammable gas.

Professor Thomassy examined the Le Bourgeois mound and pronounced it the result of the damming of a subterranean stream. Professor Lyell thinks that they may be caused either by the binding of the stratum of earth deposited in the bottom of the river by its own weight and motion, down the grade of the stream, or by the vertical pressure of accumulations of gas, or by both.

In one or two works on the antiquities of the mound-builders, there are notices of numerous anomalous mounds, generally of small size, scattered throughout the Mississippi valley. These may be mud lumps similar to the small ones surrounding the Le Bourgeois mound.—*M. H. Simons, P. A. Surgeon, U. S. Navy.*

Geological News.—The *Geological Magazine* for February contains articles upon the occurrence of Spermophilus in Norfolk, England, beneath the boulder-clay or till, by E. T. Newton; and a Supplement to a chapter in the history of Meteorites, by W. Flight. Mr. Flight notices the principal meteorites found between 1875 and 1881.——In the same magazine Mr. H. H. Howorth concludes his argument for the occurrence of a great post-glacial flood. After reviewing the theories of Pére David, Mr. Kingsmill, Baron Richthofen, etc., and pointing out that they fail to explain the occurrence of the loess at considerable elevations, the character of the loess material and the nature and preservation of its fossils, he proceeds to argue that the loess had its origin in vast outbursts of volcanic mud, a great portion of which was swept away and carried to a lower level by a deluge on an immense scale.——At a recent meeting of the Royal Institution of Great Britain, Dr. W. B. Carpenter spoke upon land and sea in relation to geological time. The conclusion supported was that the deep ocean basins date from the most remote antiquity, and that the subsidences and depressions of existing continents

have been of comparatively small vertical extent, the elevation of mountain-chains being formed by lateral thrust.——The March number of the *American Journal of Science* contains the second of a series of articles upon the flood of the Connecticut River valley from the melting of the Quaternary glacier, by J. D. Dana. The average depth of this flood, taken from the level of the wide terrace out of which the present river-bed is hollowed, was 140 feet north of the Massachusetts line, and about 125 feet in Massachusetts and Connecticut.——In the same magazine C. D. Walcott describes a new genus of the order Eurypterida, from the Utica slate. As far as known no example of the Eurypterida has previously been described from a lower horizon than the Medina sandstone.——At a recent meeting of the Paris Academy of Sciences, M. Emile Blanchard stated that the condition of the fauna and flora of New Zealand showed it to be a remnant of a southern continent submerged during the modern epoch of the earth's history.

MINERALOGY.[1]

PSEUDO-SYMMETRY.—Much interest has been excited among crystallographers in those curious crystalline forms, which, while appearing to be simple forms belonging to one system of crystallization are now regarded as composed of a number of twinned crystals of another system. These are the crystals which exhibit the "optical anomalies" for which so many explanations have been offered.

Some recent investigations in this direction appear to be overturning our most elementary mineralogical conceptions. Thus, the garnet, for example, so constant in crystalline form, notwithstanding the great variations in composition, has always been considered a type of the isometric system. Yet, by means of delicate optical investigation, the conclusion has been reached that several of the varieties of garnet are not simple dodecahedrons, as indicated externally, but are composed of twelve orthorhombic crystals symmetrically arranged around a central point. It has moreover been stated that in the case of the varieties topazolite and ouvarovite, each of these twelve orthorhombic crystals are themselves composed of four more elementary crystals, making a group of 48 crystals in all to produce each apparently simple form.

Pseudo-symmetrical crystals formed by a less number of twins arranged around a line or plane have long been known. The three crystals often twinned in aragonite, the four in harmotome, the six in witherite and the eight in rutile are familiar examples of twins symmetrically placed around a line. The repeated twinnings in the plagioclase felspars offer an example of numerous twins on a single plane.

[1] Edited by Professor HENRY CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

But the arrangement of twins around a *point* has not been known until recently. A simple example of this new kind of twinning and of the method of detecting it may be given in the case of Romeite. This mineral crystallizes in simple octahedrons, and had therefore been supposed to be isometric. Bertrand has endeavored to show that the octahedron of Romeite is in reality a twinned arrangement of eight rhombic crystals grouped symmetrically around a point. He found that if a section be cut between the summit of the octahedron and the center of the crystal, parallel to the cubic face, and this be examined in polarized light, it will show, if parallel rays be used, four similar right-angled triangles each having its hypothenuse either parallel or perpendicular to the plane of polarization; if, however, converging rays be used, each triangle will show a cross and a series of rings, indicating an optic axis for each, which is oblique to the section, but which bisects the right-angle of each triangle. If now a section is cut parallel to any octahedral face, and is examined in converging rays, a central cross and series of rings appear, just as in a uniaxial crystal, and indicate an optic axis normal to the octahedral face. He holds, therefore, that the whole octahedron of Romeite is composed of eight uniaxial (rhombic) crystals arranged around a point.

The investigations of Descloiseaux, Vom Rath, Bertrand, and more especially Mallard, tend to the belief that quite a number of apparently simple crystals of one system are in reality groups of crystals of a higher system.

Among the *pseudo-isometric* crystals, are, as Mallard has shown, topazolite, formed of 48 triclinic crystals, having for their bases the faces of a hexoctahedron, and arranged in 12 different positions; ouvarovite, formed of 12 orthorhombic crystals, corresponding to each face of the dodecahedron and arranged in 6 different positions; boracite, formed of 12 orthorhombic crystals whose summits are at the center of the crystal, as in ouvarovite; leucite, an assemblage of monoclinic crystals; senarmontite, whose octahedrons are composed of 48 orthorhombic crystals as in topazolite (this being an interesting result when taken in connection with the orthorhombic form of valentinite, hitherto supposed to be a dimorphic form of oxide of antimony); analcite, whose anomalous optical characters have long been known, now shown to be formed of 24 orthorhombic crystals, corresponding to the faces of a tetrahexahedron; fluorite, probably composed of interlacing rhombic crystals. To these, Bertrand has added Ralstonite, and, very recently, Rhodizite, both of which are composed of twinned biaxial crystals. Among *pseudo-tetragonal* crystals may be mentioned apophyllite, idocrase and zircon, now shown to be assemblages of monoclinic crystals; while as regards rutile, octahedrite and brookite, generally supposed to prove the trimorphic character of titanic acid, the interesting

conclusion has been reached by Mallard that the elementary form of titanic acid is monoclinic with tetragonal habit, and that each of those minerals represent merely different twinning arrangements of the same elementary form. Apatite, tourmaline, emerald and corundum are examples of *pseudo-hexagonal* minerals, formed by the twinning of orthorhombic crystals, while other examples might be given in the remaining systems.

Interesting as are the conclusions here reviewed, it is to be remembered that other and more simple explanations of these "optical anomalies" have been offered, which do less violence to our crystallographic ideas and are perhaps nearer the truth. Most of the mineralogists of Germany are opposed to this twinning hypothesis, and hold that all the optical phenomena in question can be explained by irregularities of internal tension in the crystal. The fact, recently discovered, that when amorphous gelatine is cast in the form of a crystal, it frequently shows, after drying, optical phenomena identical with those under discussion (*e. g.*, analcite), lends great weight to this latter and more simple hypothesis.

HIERATITE, A NEW MINERAL.—At the February meeting of the Mineralogical Society of France, M. Cossa described a new mineral which occurs in microscopic crystals in volcanic tufa around the fumaroles of the crater of the Island of Vulcano (one of the Lipari islands). The minute crystals dissolve in boiling water to form an acid solution, from which there soon separates a gelatinous substance which, after desiccation, becomes a mass of transparent isometric crystals, of which the predominant form is the cube modified by the octahedron. The composition of the crystals was found to be that of a fluosilicate of potassium $2KFl, SiFl_4$ The name, Hieratite, is suggested by the Greek name of the island, Ἱερά.

Hieratite occurs abundantly in the stalactitic concretions which cement the tufa and decomposed lava, and is associated with selensulphur, realgar, mirabilite, glauberite, sassolite; the alums of potassium, cæsium and rubidium; and the soluble salts of arsenic, iron, thallium, zinc, tin, bismuth, lead and copper.

Attention is called to the abundant occurrence of a compound of tin soluble in water, possibly an alkaline fluostannate, and to a soluble bismuth salt, both of which may be new.

MONAZITE FROM VIRGINIA.—Prof. G. A. König[1] has identified monazite from the mica mine in Amelia Co., Va., thus adding still another rare mineral to the list already reported from that locality. It occurs in masses, some of which are from fifteen to twenty pounds in weight. Two varieties were noticed, one having an amber or brown color, a straw-colored powder and a spe-

[1] Proc. A. N. S., Phila., Jan. 24, 1882.

cific gravity of 5.4; the other being gray, yellow in thin splinters, and greenish-gray in powder, and with a specific gravity of 5.1.

The mineral is decomposed by concentrated sulphuric acid and has the following composition:

$(Ce\ La\ Di\ Y)_2O_3$	$(Y\ Fe\ Ca)_2O_3$	P_2O_5	ignition
73.82	1.	26.05	.45

SOME SUPPOSED NEW SCOTTISH MINERALS.—Pilolite, Rubislite, Xantholite, Balvraidite, Abriachanite, Haughtonite, Walkerite, Bhreckite, Tyreeite and Torbermorite are names given by M. F. Heddle[1] to some supposed new minerals from Scotland. Some of these are certainly mixtures and products of decomposition; others are provisional names given to substances "which may prove to be new," and most of them require further examination before being entitled to be classed as new species. Names so given are of little advantage to the science of mineralogy. The numerous analyses given by Dr. Heddle are his most valuable contributions to science.

Pilolite is the name given to "mountain leather," usually regarded as a fibrous amphibole. *Rubislite* greatly resembles the doubtful mineral Hullite, and is found in red granite. *Xantholite* occurs in impure yellow nodules, somewhat resembling chondrodite, and appears to be an alteration product. It resembles "grenatite." *Balvraidite* is an altered felspar, resembling Bytownite. *Abriachanite* is a bluish mineral which may be either fibrous, slaty, powdery or clayey. It is a silicate of iron and magnesia and undoubtedly a decomposition product. *Haughtonite* is a black mica resembling biotite, but containing more iron and less magnesia. It is found in granite at numerous localities. It appears to be identical with the mica from Pike's Peak, Colorado, previously named, by the present writer, *Siderophyllite*. *Walkerite* is a variety of pectolite containing magnesia. *Bhreckite* is a soft, granular, pale green substance not unlike glauconite, but of uncertain affinities. It occurs in veins in granite. *Tyreeite* is the name provisionally given to a *red mud* left after dissolving a large amount of marble in hydrochloric acid. It is undoubtedly a mixture. *Torbermorite* is a massive, uncleavable zeolite whose main constituents are SiO_2 47, Al_2O_3 3, CaO 33.7 H_2O 12.4. It is said to possess no reactions distinguishing it from other zeolites.

MENACCANITE, LEUCOXITE AND TITANOMORPHITE.—A. Cathrein,[2] after a careful investigation of the titaniferous minerals of the Northern Tyrol announces the following conclusions:—

(1.) That apparently homogeneous menaccanite exhibits microscopical inclusions of rutile, and that the excess of titanic acid and the alteration of the normal ratio of Ti : Fe = 1 : 1 can be demonstrated by analysis.

[1] Proc. Min. Soc. Gt. Britain.

[2] Zeits. f. Kryst, 1882, VI, 244.

(2.) That the so-called Leucoxite is no new mineral, but is titanite with or without admixture of rutile microliths.

(3.) That the so-called titanomorphite is not a new lime titanate, but is also titanite.

(4.) That the red brown decomposition products surrounding menaccanite are rutile, not hematite, and were originally enclosed in the menaccanite, since dissolved.

NEW MINERALS.—*Heldburgite* is the name given by O. Luedecke to some minute yellow columnar crystals found in the phonolite of Heldburg, in Coburg, and supposed to be new. The mineral is associated with zircon, and somewhat resembles that species. It is infusible, transparent, with white streak and adamantine lustre, and of unknown composition.

Krugite.—This is a new sulphate of calcium, magnesium and potassium found in the Stassfurt rock-salt deposits. It is crystalline, with a hardness of 3.5, and specific gravity of 2.8. In hot water potassium and magnesium sulphates are dissolved, gypsum remaining; but in cold water the potassium sulphate alone is dissolved, the double salt K_2SO_4. $CaSO_4$ + H_2O remaining insoluble. It has the following composition: K_2SO_4 18.2, $MgSO_4$ 13.5, $CaSO_4$ 63 4, H_2O 4.1, NaCl .5—as though a mixture of anhydrite and polyhalite.

MINERALOGICAL NOTES.—The white *tourmaline* crystals of De Kalb, St. Lawrence county, New York, have been carefully measured by G. Seligman, and are the subject of an exhaustive paper in the last number of *Zeitschrift für Krystallographie und Mineralogie.*

The *boracite* crystals which occur in the kainite beds at Stassfurt are soft and pliant and under water fall to pieces to form a slimy mass. They have the same composition as the ordinary hard boracite of the carnallite beds.

By submitting crystals of *nephelite* to the action of weak hydrofluoric acid, certain etch-figures are produced which, according to a recent paper by Baumhauer, prove that nephelite crystals are always twins. The twins are regarded as the result of trapezohedral hemiedry in combination with hemimorphism according to the principal axis.

The discovery by Mr. W. E. Hidden, of remarkably fine *emeralds* in North Carolina, is of much interest. A well known Philadelphia mineralogist is the fortunate possessor of one of these emeralds, which is a perfect hexagonal prism of deep green color, having a length of over ten inches—a size probably unsurpassed by any emerald in existence.

The *prehnite* of Farmington, Conn., has, according to Descloiseaux, remarkable optical properties, probably due to the superposition of numerous lamellæ in different positions as regards their crystallographic axes.

Simple dodecahedrons of *fluorite* are very rare. They have recently been found in the department of Puy de Dome, France.

The proof of the identity of two species is as important as the discovery of a new one. Descloiseaux and Koksharow have recently shown by crystallographic measurements that *vauquelinite* and *laxmanite* are identical. Laxmanite had been distinguished from the vauquelinite of Siberia by Nordenskiöld in 1867, under the impression that the more lustrous crystals, of somewhat different form and brighter green color belonged to a distinct species.

Kieserite, a sulphate of magnesia found in the Stassfurt salt mines, when placed in water is broken up into a crystalline meal, which, on exposure to the air, sets to a hard, cement-like mass. It has been used as a cement. It has been shown that the formation of the cement is due merely to the compression of the mineral upon drying.

GEOGRAPHY AND TRAVELS.[1]

The Caroline Archipelago. — The Caroline Islands have recently been visited by the British war steamer *Emerald*. Her commander, Captain Maxwell, reports his arrival at Strong Island on June 25, 1881. He describes it as mountainous with lofty peaks, some 2000 feet above sea-level, clothed with verdure to the summits; bread-fruit, bananas, etc., grow in abundance, but cocoa-nuts are far less plentiful than in the low coral islands, and, owing to the bountiful supply of water, they are not much needed. The ancient walls and fortifications on the small island of Lélé, where the king lives, are very extraordinary. The walls are some twenty feet high, having been in former times probably as high everywhere, and twelve feet thick, and are built of enormous basaltic rocks which must have been brought from a distance, and have cost much labor and ingenuity to raise them to their present position. The natives of Strong Island are described as a most gentle, amiable and intelligent race; they are lighter in complexion than the Marshall islanders. Captain Maxwell afterwards visited Ponafi, or Ascension Island, in the Simavina group, the population of which is stated to be 5000. This island is divided into several districts each of which has its own chief. The natives are particularly pleasant and good-looking; Captain Maxwell thinks they have more refined features than any he has seen, but they are not so well dressed or advanced as the inhabitants of Strong Island—the grass petticoat, indeed, seemed to be the principal article of clothing. The island is about fourteen miles square and very beautiful, with lofty peaks from 2000 feet

[1] Edited by Ellis H. Yarnall, Philadelphia.

to nearly 3000 feet high, which are wooded to their summits, and is surrounded by coral reefs with pretty detached islets; all sorts of fruits and vegetables grow there in abundance. The ruins of residences of former chiefs are numerous and consist of enclosures within enclosures, with walls in some places thirty feet high and upwards of twelve feet thick, built of great basaltic prisms (many of them twelve feet by two feet six inches), laid regularly tier upon tier; each tier being at right angles to the one below, and the interstices filled in with coral and rubble.[1]

THE PAMIR.—The Russian traveler, M. Severtsof, gives the following results of his last journey in the Pamir: The Pamir is not a table-land and has no steppe region up to the height of about 12,000 feet. Up to an elevation of some 14,000 feet, the rivers flow in valleys which never exceed about thirteen miles in width. This peculiarity occurs also in the Tien Shan and Tibet where narrow valleys are found at a considerable elevation. There are, however, no lofty plateaux in the Pamir, where the mountains rise in lofty ridges 6000 or 7000 feet above the level of the valleys. In the Pamir mountain system, M. Severtsof states that 19,000 feet above the level of the sea is often reached, while three mountain groups attain an absolute elevation of 25,000 feet. He says, however, that these elevations do not alter the generally symmetrical character of the Inner Pamir. The mountain lines stretch in the direction of the meridian, and seldom strike out at right angles, in which respect they resemble those in the Tibetan system, while in the Tien Shan there is a tendency to parallel ranges. M. Severtsof is of the opinion from the evidence he obtained, that in the Inner Pamir the groundwork of the system, the elevation, which in 12,000 years has risen 600 feet, is still going on.

ALASKA.—Mr. E. W. Nelson has recently returned to Washington after four years spent in Alaska, chiefly at the U. S. Signal Station at St. Michaels, on Norton Sound, where he was sent by the Smithsonian Institution to study the meteorology and natural history of the region. The New York *Herald* states that he has made exhaustive researches in the mammalogy, ornithology and ichthyology, as well as in the ethnology and physical geography of the surrounding country. He made extensive sledge journeys and obtained a very valuable collection of Eskimo implements and utensils, and has brought back with him many water-color sketches of birds and fish, photographs, and also much information concerning the language and life of the Western Eskimo.

POLAR STATIONS.—The Austrians are making active preparations to establish their polar station at Jan Mayen.

The Germans have appointed a commission to make the neces-

[1] Royal Geographical Society *Proceedings*, February, 1882.

sary arrangements for the erection of their station, while the Russians, having already, as previously mentioned, dispatched their expedition to the mouth of the Lena, are fitting out another to go to Novaya Zemlya.

The Dutch also expect to continue their explorations in the Arctic seas.

DR. CREVAUX IN SOUTH AMERICA.—Dr. Crevaux, the French explorer in the Guianas and the basin of the Amazon, has been dispatched by his government on another journey. He is accompanied by an astronomer and other assistants. He proposed to ascend the Paraguay River to the headwaters of the Amazon, and to make a thorough exploration of the Tapajos tributary.

The Emperor of Brazil having placed a steamer at his disposal, he has decided to proceed up the River Pilcomayo to ascertain the practicability of a trade route between the Bolivian interior and the Argentine Confederation.

AFRICAN EXPLORATION.—The Marquis Antinori, the leader of the Italian expedition in Shoa, has heard of the existence of a race of pigmies to the south-east of Kaffa. It is thought probable they belong to the same race as the Akkas. The Marquis expects to return to Europe soon. He has made, during his five years residence in Africa, a large ornithological and entomological collection. He says that the natives distinguish clearly between the true leopard, the gepard *(Cynailurus guttata)* and *Pardus varius*, but that there is a fourth species, called by them "abasambo," and apparently intermediate between the lion and the leopard.

Mr. Schuver writes to the *Mittheilungen* stating that he never intended to cross Africa from north to south, as has been reported. Fadasi, according to him, lies in N. lat. 9° 48′, or forty-three miles north of the position given by Marno.

The *Academy* states that Captain Cecchi has returned from Northeast Africa, and it is expected that he will shortly give an account of his travels in the Galla country, where he visited the Gurangué tribe, previously unknown to Europeans. He describes them as the most handsome and intelligent of the races in Eastern Africa. They are surrounded by the Gallas, against whom they defend themselves vigorously. A tradition respecting Christianity exists among them, and further research may perhaps discover ancient Ethiopian MSS.

The Russian African Expedition, of which mention was made in our last number, intends to explore the Liba rivers of West Africa, forming a station at the island of Fernando Po. After this region has been explored, the party proposes to continue their journey across the continent to the Uganda and Galla countries.

GEOGRAPHICAL NOTES.—The French Scientific Expedition on board the *Travailleur*, and of which M. Milne-Edwards was the head, has been recently exploring the western portion of the Mediterranean. The seas off the coasts of Provence and Corsica were carefully explored to a depth of over 8700 feet, and after dredging between Spain and the Balearic Islands, the *Travailleur* put into Tangier, which was the point of departure for the second part of the voyage in the Atlantic Ocean. The numerous soundings and dredgings off the coast of Portugal produced some remarkable results, as they revealed the presence, at a depth of from 4900 to 5900 feet, of large fishes of the shark family which exist there in large numbers without ever coming to the surface. In returning to Rochefort, the greatest depth which has ever been found in the seas of Europe, was obtained by the dredge in 44° 48′ 30″ N. lat., 4° 40′ 15″ W., viz., 16,733 feet. A great number of foraminifera and radiolaria, several crustacea and an annelid were found in the mud here brought up by the dredge. As regards the Mediterranean, the *Travailleur* expedition has proved that this sea has no fauna of its own, this want being supplied by immigration from the Atlantic Ocean.

The Russian scientific expedition to the mouth of the Obi, has determined a number of positions astronomically. The eastern coast line of the gulf has been found to be placed from twenty to twenty-five kilometers too far to the east on the maps. If a similar correction is to be applied to the west coast, it will make the Yamal peninsula very narrow.

It is estimated that a third of Asia and a thirtieth part of Europe still remains to be explored.

Colonel Prejevalsky is actively engaged on his great work on Tibet and China, the first volume of which will be published in May with a map.

Nature notices the Journal of the Geographical Society of Tokio. It is printed wholly in the Japanese characters. It contains a paper on Saghalin and the Kurile Islands, and one on the historical geography of Japan.

MICROSCOPY.[1]

THE NEW TRICHINOSCOPE.—So long as the detection of trichinæ in the flesh of animals used for food was solely a scientific curiosity and sanitary precaution, it naturally devolved upon scientific students to whose instruments and skill it presented no difficulties whatever; but when by depreciating, to a great extent falsely, the market value of a staple article of food, and inter-

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

fering with the distribution of one of the great articles of export from this country, it became a question of national and commercial importance, there arose a need for some means by which unscientific persons, acting merely in the interest of trade, could determine with facility the presence or absence of these parasites. A thorough examination of the pork offered for sale must not only prevent the use of that which is dangerous, but also show the gross exaggeration of the prejudice recently excited against

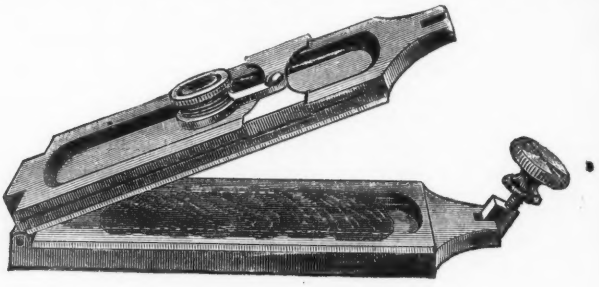

FIG. 1.

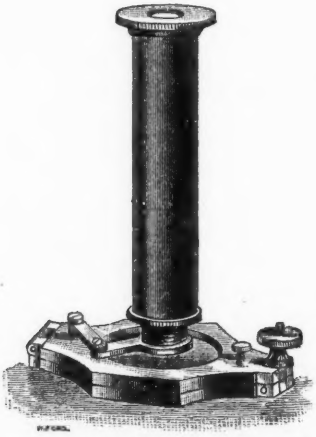

FIG. 2.—THE NEW TRICHINOSCOPE.

this article of food. Perhaps no means is so available for this purpose as the trichinoscope produced by the Bausch & Lomb Optical Co., of Rochester. This instrument consists of a compressorium with a magnifying arrangement so mounted that it can be easily slid over the whole surface of the fragment of flesh which has been flattened between the glasses. In the form shown in

Fig. 1, the compressorium is long and narrow and fitted with a pair of 3 x 1 glass slips, such as are commonly used by microscopists, and it is supplied with a magnifying doublet of sufficient power for the easy recognition of trichinæ. Instead of the doublet, or compound microscope tube may be used, in which case it is best combined with a short compressorium having round disks of thin glass as shown in Fig. 2. On the whole, the simplest form, as drawn in Fig. 1, is considered preferable, and it is furnished at the remarkably low price of $3. Aside from its intended use, this instrument is an excellent pocket microscope for field use when making collections of algæ and infusoria among the ponds and ditches.

STRUCTURE OF THE COTTON FIBER.—Foremost among the instances of the present day, of the application of scientific methods and instruments to the development of economical interests, is the microscopical study of fibers and fabrics. The three lectures on the structure of the cotton fiber, delivered by Dr. F. H. Bowman before the Bradford Technical School in 1880, have been published in Manchester, and they constitute a volume of remarkable interest and value.[1]

Dr. Bowman combines, in a rare degree, the love of truth and the analytical methods of a scientist with the practical sense of a business man, and his book, though intended primarily for the instruction of cotton spinners and others concerned in that industry, is a still greater acquisition to the library of the botanist and the microscopist. The development, size, structure, and varieties of the different kinds of cotton fibers known to trade, their varieties of place and season, their qualities and faults, and their behavior under the processes of preparation, dyeing and spinning, are discussed with great thoroughness, and are illustrated with good drawings. A companion book on the structure of wool is promised by the same author. Thus is opened by science a field, whose importance has scarcely been realized before, for the practical improvement of those engaged in the manufacture of fabrics. The author's incidental directions for the microscopical examinations upon which the whole work is founded, are in the main judicious and excellent, and we fully concur in his assumption that the best attainable objectives are desirable for the work; though the experience of the present day is rather in favor of the employment, for such work, of smaller and simpler stands instead of those as large and elaborate as the one figured by him. The author does not specify the powers most available; but we have found a 1 inch or 1½ convenient for preliminary survey of the material, or $\frac{4}{10}$ for the study of its general character, and a $\frac{1}{18}$ or $\frac{1}{8}$ immersion for study of sections, local details, effects of dye

[1] The Structure of the cotton fiber in its relation to Technical Applications. By F. H. Bowman, D. Sc. 8vo, pp. 211, plates 11. John Wiley & Sons, 15 Astor Place, New York. $4.

stuffs, etc. These lenses should all be of very high angle, unless the expense be a positive objection. An instrument costing $50 to $75, would be sufficient for every-day use in a mill for examining the stock as received and worked up; but one worth $300 is none too good for a person designing to give advice and decisions as an expert in obscure cases.

The editor of the Boston *Journal of Commerce* has introduced the microscope into this field in this country, and has already in important cases detected the cause of the imperfect working of cotton apparently of good quality. He strongly endorses the practical value of the use of the microscope by the cotton mill agent or superintendent, specifying, among other things, that "it tells him the effect of different mordants at a glance, the effect of various chemicals which are used, also the real value of different dye stuffs or drugs, and wherever the mixing of fibers is followed or the actual fabric of goods is to be investigated, there is no other possible way to do it than by the microscope."

The prominence which the microscope is assuming in this country in this technical application, may be judged from the fact that in the catalogue of instruments, apparatus, etc., for designers and others engaged in the manufacture of textile fabrics, by A. & A. F. Spitzli of West Troy, N. Y., of the 118 pages of the catalogue, the first 48 are devoted to microscopical apparatus. Messrs. Spitzli also publish a "Manual for managers, designers and weavers," an octavo book of 250 pages, which is of interest to all, whether of scientific or of practical intent, who are desirous of studying thoroughly the structure of fabrics.

PRACTICAL MICROSCOPY.—Under this title Mr. George E. Davis, editor of the *Northern Microscopist*, has issued a general text-book of the microscope and its manipulation. It is a work of over 300 octavo pages, illustrated with wood cuts, and published by David Bogue of London. The author announces his intention, with a cheaper and more modern book, to occupy much the same field as did Queckett's now obsolete treatise on the "Use of the Microscope." He practically makes good the claim to be a successor of Queckett by ignoring American and continental apparatus almost entirely, and confining himself to descriptions of English work. Moderate credit is given, in the preface and elsewhere, for American precedence in the introduction of high angled objectives; but these objectives (or any of American make for that matter) are omitted from the practical part of the work. Only one American stand is described, and the accessories mentioned are almost exclusively English. While this peculiarity may make the book more convenient for practical use among its largest constituency, nearer home, it will render it somewhat less attractive and satisfactory to American students.

A similar deficiency occurs in the bibliography of algæ, infusoria, etc., of minerals, and mosses, where no mention is made of

even such elegant works as Wood's Fresh-Water Algæ, Leidy's Fresh-Water Rhizopods, Zirkel's Microscopical Petrography, and Sullivant's Icones Muscorum. On the other hand, the American style of naming oculars by their degree of amplification, as 2-inch, 1-inch, etc., is noted with approval; as is also the adoption of the metric system in micrometry, and especially the selection of the one-thousandth of a millimeter, under the name of micro-millimeter or micra, as the unit to be employed. The question of angular aperture, and of testing objectives, is discussed with candor and freshness. The later chapters of the book treat of collecting objects, dissections, section-cutting, drawing and measurements, polariscope, micro-spectroscope, staining and injecting, and preparing and mounting objects. While giving recipes for various reagents and mounting media and cements, the author offers the very sensible advice that parties who require only small quantities should purchase them from a dealer instead of attempting their manufacture. He also advises against the use of "secret nostrums." Natural history subjects, which form so large a part of some of the manuals, are only touched upon incidentally. The work is freely illustrated, though only one of the plates is accompanied by a scale showing the magnifying power employed.

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SCIENTIFIC NEWS.

— In the Kansas City *Review*, Mr. L. F. Ward gives the following sensible views as to the reasons why the Western plains are destitute of forests. He considers that the prairies are without forests, because of fire set by Indians: Since the elevation of the Rocky Mountain range at the close of the Tertiary age, the atmosphere, in the general easterly movement which it possesses at all latitudes within the United States, has at all times lost the greater part of its moisture by condensation upon the cold summits of these and the more western ranges, so that by the time it reaches the great plains it is too dry for precipitation except under unusual conditions. As it moves still further eastward across a level country, having river valleys and lake basins, it comes in contact with currents from the north, the south and the east, brought there by the constant disturbances of barometric pressure with which all are acquainted, and in this manner it gradually becomes at length again sufficiently laden with moisture to yield portions of it to the soil when condensed by currents of unlike temperature. This characteristic becomes more and more marked with the eastern movement until the Mississippi valley is reached, in which and at all points eastward the rain-fall, varying from thirty-two to sixty inches is sufficient to be depended upon for agricultural purposes.

Where the annual precipitation is below twenty, or perhaps

twenty-four inches, there can be no growth of forests, and this is the true cause of the absence of trees on the great plains. But this does not prevent the existence in arid regions of certain specialized types of arborescent vegetation. The sage brush that covers the dreary wastes of the Rocky Mountain region, the Laramie plains, the Bitter creek valley, and such vast areas of the West, while in its botanical characters it is little more than an over-grown weed, is to all intents and purposes a tree, and often attains a great age. The region it occupies is even more arid than the great plains, yet no fires occur and no forests grow. In the nearly rainless areas of Arizona, Southern Utah and New Mexico, and stretching eastward into Texas, there occur a number of arborescent forms, the creosote bush *(Larrea mexicana)*, the mesquit *(Prosopis juliflora)*, various acacias and mimosas, and one yucca *(Y. brevifolia)*, together with the tree cactus *(Cereus giganteus)*. These grow scattered at great distances from each other and rarely form thickets or groves. Why no such characteristic species are found occupying the great plains is not known, and it is probably a mere accident that none happens to exist, adapted both to their temperatures and their arid condition. Did any such exist, there seems no reason why it might not thrive as well as the sage brush farther west or the mesquit of the South.

The absence of forests or extensive tracts of timber land on those areas of our Western country where the rain-fall annually exceeds twenty-four inches, must, as already remarked, be attributed to human agency in repeatedly burning over these areas, whereby all forms of vegetation requiring more than one season to mature their fruit are prevented from perpetuating their kind.

— The Board of Control of the Iowa Agricultural College at their last annual meeting passed a resolution that the College Board would provide a competent entomologist for the State, paying his salary out of the college fund, *provided that* the legislature would defray the other expenses. A bill has accordingly been introduced into the legislature now in session, with a good prospect of becoming a law. It provides that the teacher of entomology in the Iowa Agricultural College shall be *ex officio* the State Entomologist. It is made his duty to visit different parts of the State upon direction of the governor, to study the injurious insects. He is also to make an annual report, and this report shall be in two parts, "the first of which shall be written in plain non-technical English for popular perusal, while the second part shall include the necessary technical descriptions."

Provision is made for the printing and distribution of five thousand copies of the report. Provision is also made for paying the expenses of making visits to different parts of the State, and for supplying the necessary cuts and illustrations. The direct appropriation from the State treasury (not counting the printing of the

report) will be only six hundred dollars annually, but no part of this is to be used for payment of the salary of the entomologist. One valuable feature of this plan is *its permanence* when once under way.

Mr. Herbert Osborn (now studying with Dr. Hagen) well known in Iowa for his scientific and popular writings on insects, a young man, and warm friend of the lamented Putnam, is the teacher of entomology in Iowa Agricultural College, and it is to be presumed that if this bill becomes a law, he will be the State Entomologist of Iowa.

— Professor C. V. Riley has deposited in the U. S. National Museum his extensive private collection of insects. The collection comprises some 30,000 species and upward of 150,000 specimens of all orders, and is contained in some 300 double folding boxes in large book form and in two cabinets of eighty glass-covered drawers. The specimens are all in admirable condition, and the determined species duly labeled and classified. The collection is chiefly valuable, however, for the large amount of material illustrating the life-histories, habits, and economy of species, 3000 of which are represented in one or all of the preparatory states, either in liquid in separate boxes, or blown and mounted dry with the imagines. Fifteen blank books are filled with notes and descriptions of these species, most of them yet unpublished. Though several special collections surpass it in a single order, few, if any, general collections of North American insects equal it, and perhaps none from the biological point of view.

The Museum is now prepared to properly care for such collections, under direction of Professor Riley, who has been appointed honorary curator of insects, and it is hoped that in time, with so good a beginning, a truly national exposition of the insect fauna of the country will be brought together. The Museum building is entirely fire-proof, and there is every facility for the safe preservation of specimens or collections that may be donated. He requests that correspondents send the adolescent states in connection with mature forms whenever possible, together with all material exemplifying the transformations, architecture and economy of species.

— Sir Charles Wyville-Thompson, who was well known as the director of the *Challenger* Expedition, and author of the "Depths of the Sea," died at Edinburgh early in March, at the age of 51. Professor E. Desor, of Neuchatel, Switzerland, well known as a student of glaciers, of zoölogy and anthropology, died last March. He lived when a young man for several years in this country, and paid a good deal of attention to American marine zoölogy, and to glacial geology. Among botanists we have to record the death of T. P. James, of Cambridge, Mass., who, at the time of his death

(Feb. 22), was preparing a descriptive work on the mosses of the United States. The most eminent of French botanists, Joseph Decaisne, died Feb. 8, aged 74. He was the director of the Jardin des Plantes at Paris.

—A Correction.—In the April NATURALST, p. 292, in our article "Is Limulus an Arachnid?", I quote the published statements of the late Willemoes-Suhm, that the East Indian *Limulus rotundicauda* passed through a free-swimming nauplius stage. It now appears, as we learn from Prof. Faxon, from a letter from Mr. Murray, who was on the *Challenger*, "that the whole thing was a blunder of Willemoes-Suhm's, and that he had the larva of a Cirriped instead of a Limulus. A blunder which Suhm himself rectified." It was evidently overlooked by the editors of his "letters," and we have failed to find any rectification of the blunder in the *Zeitschrift für wissens. Zoölogie* or elsewhere.—*A. S. Packard, Jr.*

—Professor R. E. Call of DesMoines, Iowa, is preparing for a second collecting trip to the South in the interests of conchology. The collections of the present season will be confined to the State of Georgia, the greater portion of which has never been explored. It is notorious that most of the Georgia *Uniones* are rare in collections, and many of them rare even in Georgia.

The number of full shares will be again limited to *twenty-five*. The expenses of a trip of this nature are very great, and, with so limited a number of shares, it is necessary to place the price of each *full* share at $20, and *half* shares at $15. Subscriptions are due when the shares are delivered.

— The Census Bureau has issued statistics of the production of precious metals in the U. S., by Clarence King, with useful, graphic presentations of the results. The bullion product of the United States, for 1880, was $74,490,620. The United States produce 33.13 per cent. of the gold yield of the whole world, 80.54 per cent. of the silver, and 40.91 per cent. of the total.

— A fellowship in mining has been established at Princeton, which is to be opened to the senior class and to post-graduate students. The income of the fellowship is $600, and the fellow will be required to spend one year in the continuous study of the mines and mining interests of Colorado. The first award will be made on examination next June.

— The younger naturalists of Boston, Mass., have formed an association called the "Boston Zoölogical Society," which publishes a quarterly journal, of which two numbers have been issued.

— The methods and results of a study, by Capt. W. H. Dall, of the currents and temperatures of Bering sea is a timely and useful publication, issued by the U. S. Coast and Geodetic Survey.

— A third edition of Quenstedt's Handbuch der Petrefaktenkunde is now being issued in numbers. The first lieferung begins with the fossil mammals.

— The Transactions of the American Fish Cultural Association, tenth annual meeting, comes to us, containing some excellent matter.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PHILADELPHIA ACADEMY OF SCIENCES. Oct. 11, 1881.—Dr. H. C. Wood, in the course of a lecture on diphtheria detailed various experiments and observations made by himself and Dr. H. Formad with a view to ascertain the cause of that disease. Inoculation under the skin of some of the lower animals with diphtheritic poison failed to produce the disease, but inoculation by the windpipe caused death with diphtheritic symptoms. Other irritants similarly introduced produced false membrane.

Samples of diphtheritic poison were then obtained from Luddington, on Lake Michigan, where diphtheria of the most virulent type raged, chiefly in the third ward, which was built upon a swamp filled up with sawdust. Micrococci swarmed in the blood of the children suffering from the disease at this place, and this diphtheritic matter produced all the symptoms of malignant diphtheria, attended with swarms of micrococci in the blood, in animals inoculated with it. These micrococci existed in the white blood corpuscles to the number of forty or fifty in each, causing the disintegration of the corpuscle. They abounded also in the spleen and bone marrow. In suitable liquids infected with the diphtheritic matter from Luddington, it was found that generation after generation of micrococci could be produced indefinitely, whereas the matter from the milder type of the disease prevailing in Philadelphia, exhausted its productive power in three or four generations. Micrococci are present in healthy throats, but lack this power of continued development. Micrococci obtained on filter paper from the watery discharges of malignant cases proved more fatal when planted in animals than the membrane itself. Micrococci grown in liquids reproduced diphtheria when introduced into animals. The inference to be drawn was that the micrococci were the active agents in producing the disease, while their existence in healthy persons was explained by the supposition that, as is known to be the case with some fungi, the same organism which is innocuous under some conditions, may become harmful under others. It was also suggested that inoculation with the cultivated poison of exanthematous diseases might eventually be practiced as a protection against severer attacks.

Oct. 18.—Mr. Meehan called attention to two forms of willow leaves from the same tree, one form an inch in width, the other not more than a line, and argued that this tended to show the production of variations by sudden leaps.

He also spoke of an Arceuthobium (mistletoe) from the Pacific coast, the seeds of which were forcibly expelled to some distance.

Mr. Ryder described *Licnophora cohnii* Clap., a ciliated protozoan found on a hydroid at the mouth of Chesapeake bay. The hydroid was parasitic on the shell of a bivalve mollusk inhabited by a hermit crab.

Oct. 25.—Mr. Pike made a communication upon the celebrated insect-bearing deposits of Mazon creek, Illinois. These fossils are usually found in nodules of blue shale.

Nov. 1.—Mr. Ryder stated that efforts had been made during the last two summers to delay the development of fish eggs with a view to transportation. These experiments were only partially successful. At a temperatnre of 53° development proceeded normally, but more slowly than usual, up to a certain point, when a fungus formed upon the egg membrane. Temperature slightly lower than 53° caused abnormal development, and 45° proved fatal. Professor Brooks had found in the case of oyster eggs that the phenomena of segmentation and nuclear division were rythmical, and Mr. Ryder held that there was a direct relation between these phenomena and heat as a mode of motion.

Nov. 8.—Mr. Meehan said he had lately found *Robinia viscosa*, which he believed had never been collected by botanists since its description by Michaux, growing abundantly in gardens near the Delaware Water Gap. It was said to have been brought from the neighboring mountains. The plant produced a multitude of flowers, but very few seeds. The rose acacia of the nurseries has never been known to produce seeds.

Mr. Ryder described the development of Hippocampus. The quadrate, hyo-mandibular, and symplectic cartilages are largely developed, the intestine is provided with a curious valvular arrangement at its posterior end; and the plates, which are much fewer than in the adult, are developed as conical caps immediately under the epithelium.

Mr. Potts indicated a new species of sponge under the name of *Mayenia craberiformis*. Sponges occur only in flowing, drinkable water. He had found from four to six species in every stream he had examined.

Nov. 15.—The Rev. Dr. McCook spoke of the methods of escape practiced by orb-weaving spiders when thrown into the water. Some apparently formed a little raft of web for their hinder feet, and paddled ashore with their fore feet; while another further out allowed threads to float upwards from its spinnerets, and was wafted ashore by the wind. These two methods were both probably instinctive.

Nov. 22.—Mr. Ryder gave the results of his studies of the division of cell nuclei. Dr. Horn described the peculiar struc-

ture of the mandibles of a Balaninus which bores through hickory nuts. The mandibles are reversed, so as to move in a vertical direction.

Dec. 6.—Mr. Potts referred to three species of fresh-water sponges, the statoblasts of which are provided with long curled tendrils, homogeneous and continuous with the chitinous coat; these forms constituted the genus Carterella. Mr. Ryder stated that the silver gar and other allied fishes had eggs provided with long cylindrical filaments, which twist with those of other eggs so as to form masses of several hundreds.

Professor Rothrock stated that in *Ceanothus prostratus*, the chlorophyll of the leaves is confined to a layer around inward-growing sacs, in the interior of which are the stomata. These sacs are protected by downward-growing hairs.

THE BIOLOGICAL SOCIETY, Washington, D. C., March 3.—The twenty-third regular meeting of the Biological Society was held at the above date in the lecture room of the National Museum, at which ninety members were present, Professor Gill in the chair. A discussion of the shape of the sea-cow's tail, continued over from the previous meeting, was carried on by Mr. H. W. Elliott, Dr. Elliott Coues, Mr. F. W. True, Dr. T. H. Bean, Mr. G. Brown Goode, and Professor Theodore Gill. The committee on lectures announced that in conjunction with a similar committee from the Anthropological Society they had arranged for a course of eight popular lectures on scientific topics. The programme is as follows: March 11, Professor Theodore Gill, "Scientific and Popular Views of Nature contrasted;" March 18, Major J. W. Powell, "Outlines of Sociology;" March 25, Professor C. V. Riley, "Little-Known Facts About Well-Known Animals;" April 1, Professor Otis T. Mason, "What is Anthropology;" April 8, Professor J. W. Chickering, Jr., "Contrasts of the Appalachian Mountains;" April 15, Dr. Robert Fletcher, "Paul Broca and the French School of Anthropology;" April 22, Professor William H. Dall, "Deep-Sea Exploration;" April 29, Dr. Swan M. Burnett, "How We See." These lectures will be delivered in the lecture room of the National Museum, beginning at half-past 3 P. M.

BOSTON SOCIETY OF NATURAL HISTORY, Mar. 15.—Mr. William Trelease described the structures which favor cross-fertilization in several plants, and Mr. J. S. Kingsley remarked on the embryology of fishes.

April 5.—Professor G. F. Wright described the "Terminal moraine of the great ice period in Pennsylvania," and Mr. N. F. Merrill read a second paper on the lithological collection of the Fortieth Parallel Survey.

NEW YORK ACADEMY OF SCIENCES, Mar. 27.—Professor Thomas Egleston remarked on the proposed Government Commission for the testing of iron and steel.

April 3.—Dr. George E. Beard read a paper (with illustrations) on the psychological explanation of the Salem witchcraft excitement, and the practical lessons derived therefrom.

MIDDLESEX INSTITUTE, Feb. 28.—L. L. Dame, president, delivered an instructive lecture—the first in a series of twelve weekly botanical lectures—on the "Growth of the plant from the seed," to a class of nearly fifty members.

Mar. 7.—Mrs. A. J. Dolbear gave the second in the series, her subject being "Morphology of roots, stems and branches."

Mar. 8.—President Dame briefly reviewed the first year's work of the Institute, and made some excellent suggestions in regard to the best manner of carrying on the work which the Institute had undertaken.

The various reports presented a most gratifying exhibit of the condition of the Institute, and its future as a permanent scientific educational force seems well assured.

Mr. Davenport announced the death of Professor Thomas P. James, an honorary member, and a committee consisting of the president, W. H. Manning and Mr. Davenport was appointed to draw up suitable resolutions of respect to the memory of the deceased.

AMERICAN GEOGRAPHICAL SOCIETY, March 21.—R. E. Colston delivered an illustrated lecture on modern Egypt and its people, the army of Egypt and the military revolution in progress there. the customs of marriage and divorce, and the condition of women in Mussulman countries.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE, April.—The wings of Pterodactyles, by O. C. Marsh. Sandstones having the grains in part quartz crystals, by A. A. Young. The timber line, by H. Gannett. Notice of Fisher's "Physics of the Earth's Crust," by C. E. Dutton. Great dyke of Foyaite or Elæolite-syenite in Northwestern New Jersey, by B. K. Emerson. Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, by A. E. Verrill.

THE GEOLOGICAL MAGAZINE, March.—Supplement to a chapter in the history of meteorites, by W. Flight.

JOURNAL OF CONCHOLOGY, Oct. 1881.—Life history of *Helix arbustorum*, by J. W. Taylor.

THE June number of the NATURALIST will be devoted almost exclusively to articles on Evolution. It will contain articles by Morris, Hyatt, Cope, Rockington and others, with reviews of Beale, Bütschli, Loew, Pokorny, Wythe and others.